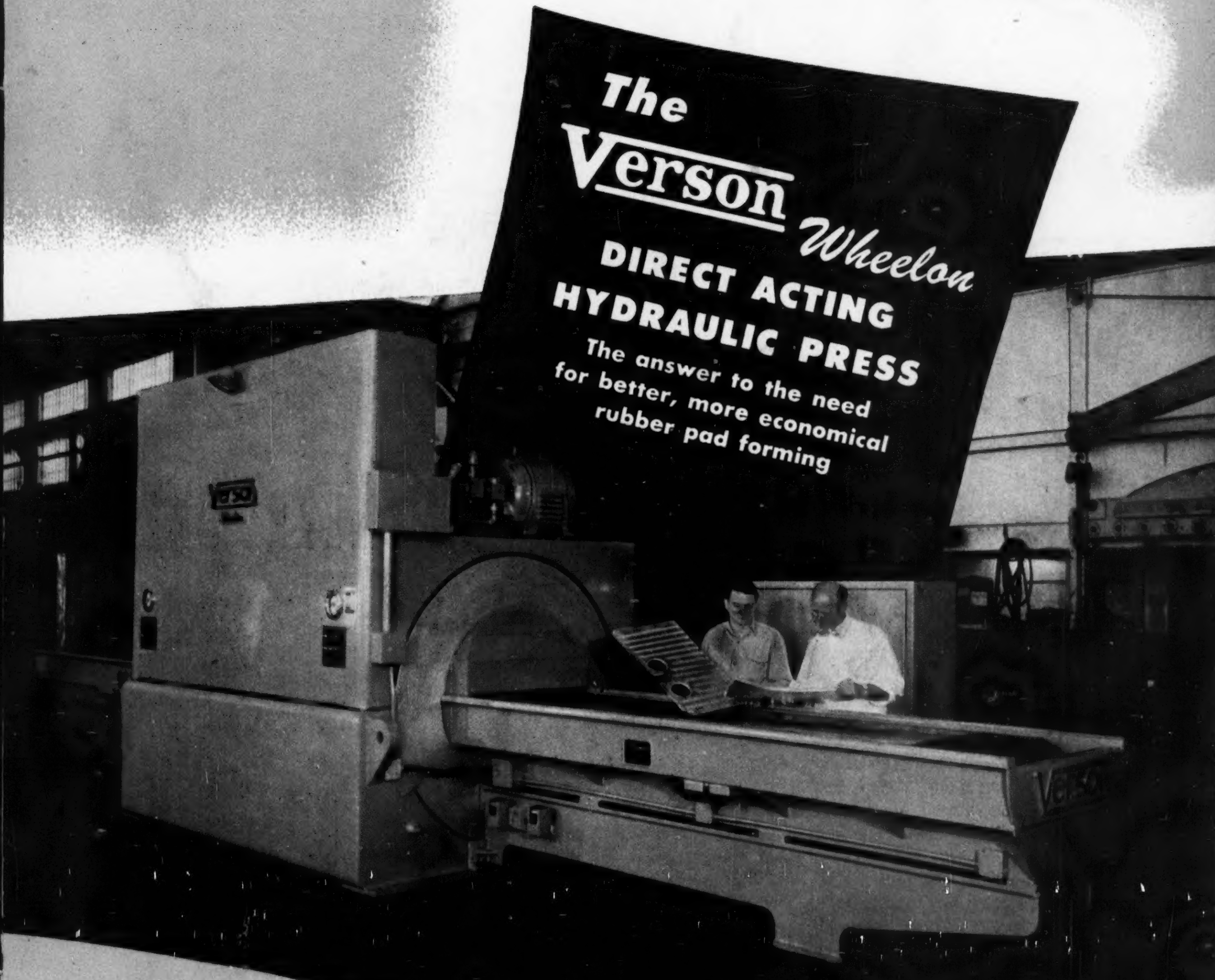
AUGUST, 1953 — FIFTY-NINTH YEAR

MACHINERY



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The Monthly Magazine of Engineering and Production in the Manufacture of Metal Products

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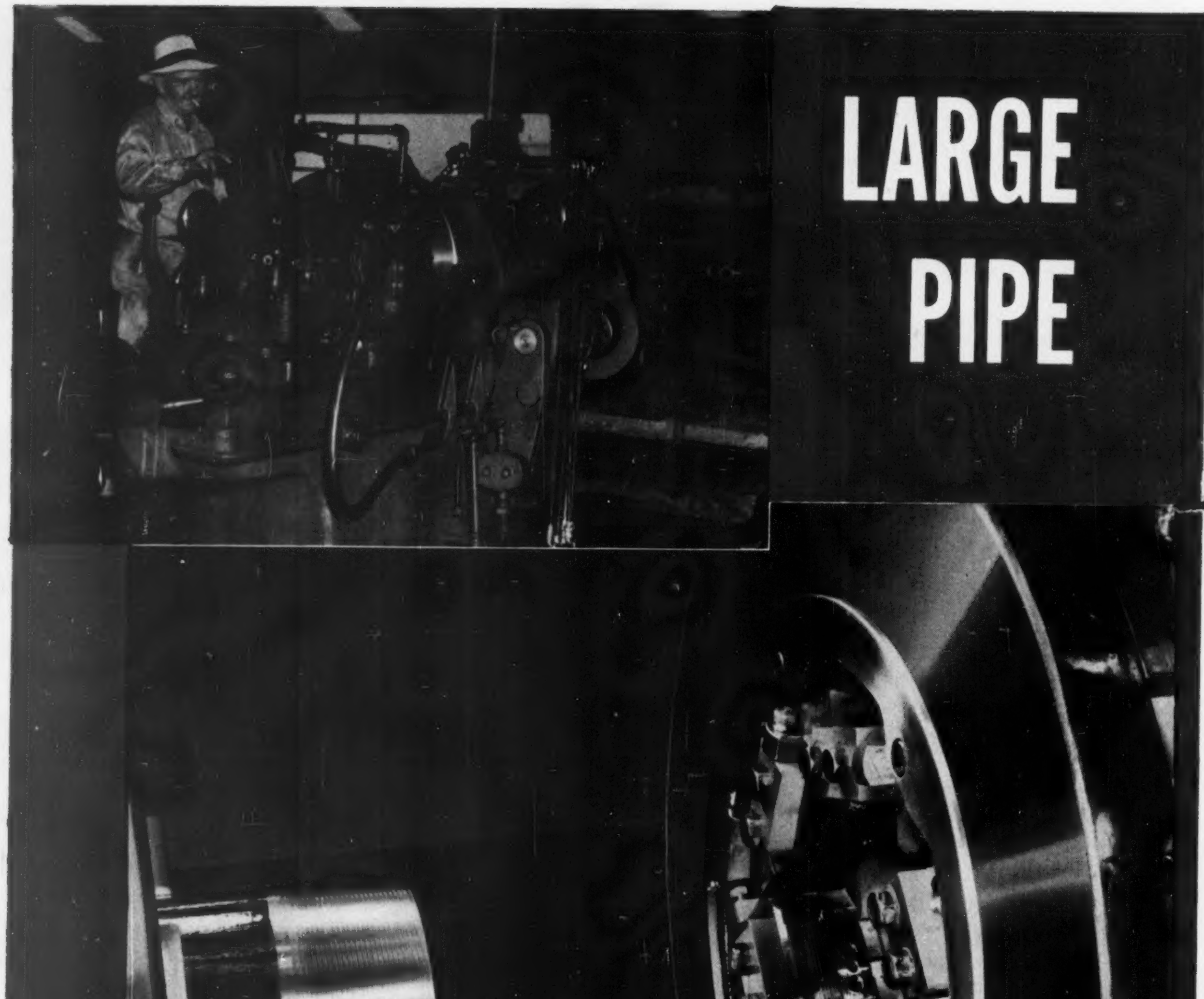
LARGE
PIPE
THE WORLD'S LARGEST MANUFACTURERS

TEXAS SHOP USES LANDIS MACHINES *Exclusively*

TEN LANDIS Receding Chaser Pipe Threading Machines are used by Atlas Pipe, Inc., largest mill-type pipe finishers on the Gulf Coast, for threading oil tubular goods.

These machines are installed in an offset position so as to permit uninterrupted production. Typical production figures show: the 4¾" machines threading 74 joints (148 threads) per hour from 2⅜" upset tubing—the 8⅝" machines averaging 20 joints (40 threads) per hour from 5½" casing. All threads are 8 pitch to API standards.

Mr. Becker, Plant Manager, highlights the important production advantages of LANDIS Pipe Machines when he says that they were selected for their flexibility, versatility, and the uniform threads produced. Thread uniformity is made possible by massive construction, leadscrew control of the carriage movement, a precision-built die head featuring LANDIS Tangential Chasers, and an attachment which mechanically controls the degree of taper.

These machines offer flexibility through wide range coverage—three sizes of machines (4¾", 8⅝", 13⅜") thread all pipe sizes from 1⅝" to 13⅜". Ease ot set-up is important—a change of diameter and length in less than 2 minutes, a complete change for diameter, pitch, taper, and length in 40 minutes.

LANDIS Receding Pipe Machines perform four other pipe fabricating operations in addition to threading: cutting off, chamfering, reaming, and the making and breaking of collars. For more complete information, please ask for Bulletin C-77.

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Aircraft production in Canada, too, finds in the Fellows Method the *production and quality control* so vital to the successful manufacture of both reciprocating and jet engines. The coordinated line of Fellows equipment for cutting, finishing and inspecting gears provides close-tolerance control in every step of gear production. Wherever you are, a Fellows representative will be glad to discuss with you the control features and economy of the Fellows Method as applied to your gear production problems.

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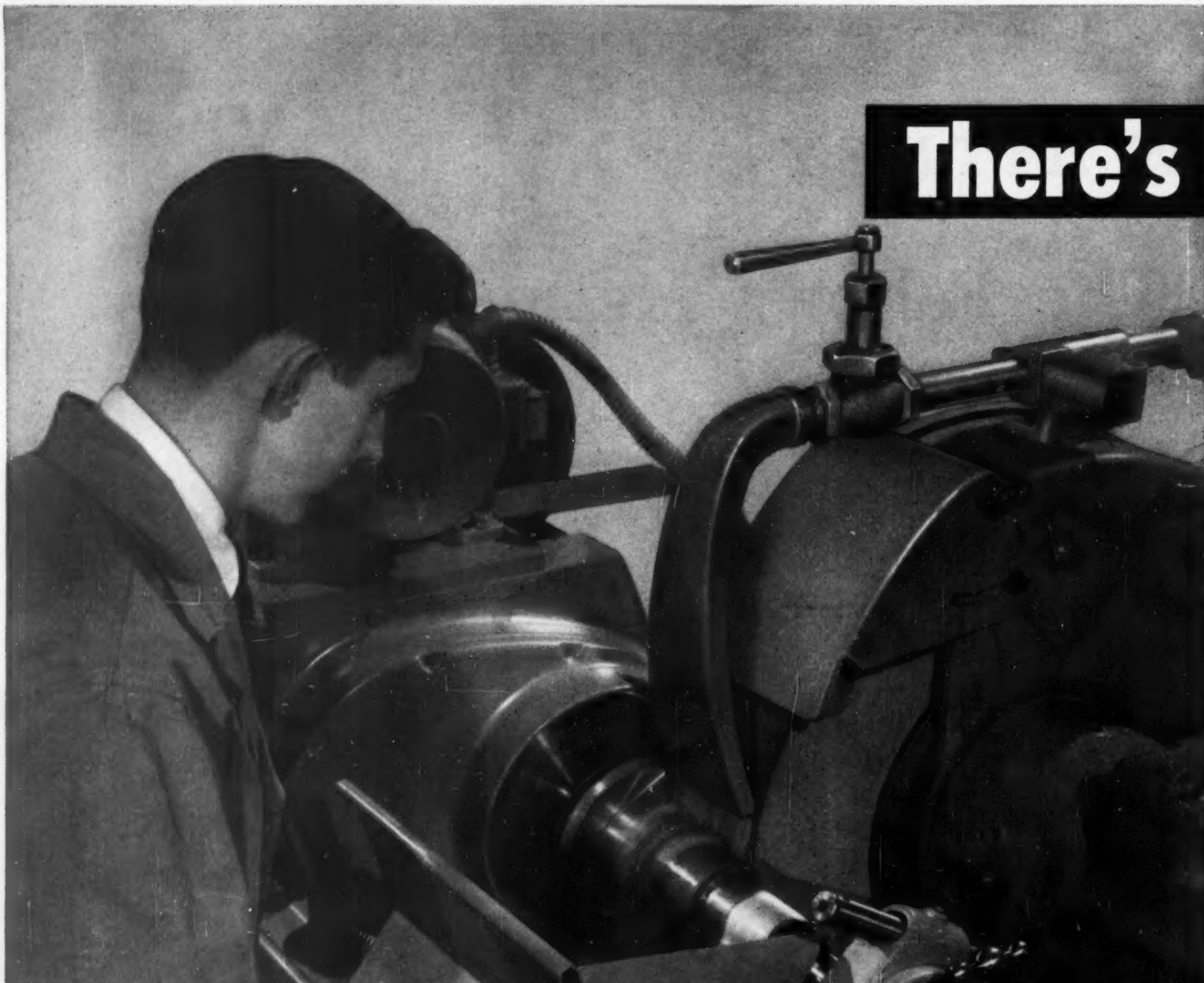
There's

No Time Like the Present

To Replace Your Worn-Out Plain Grinders

Proper timing spells success in farming, driving a golf ball, making an investment. Proper timing in replacing shop equipment is right now . . . right now while business is good and deliveries of many types of machine tools have improved. ¶In the field of precision centertype grinding, machines that no longer earn their keep should be replaced now, and your best replacement bet is CINCINNATI FILMATICS. For example, consider the medium-sized group, 6", 10"-L, 10" and 14"-L. There are many reasons why these machines should be your first choice:

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FILMATIC

You can reduce the cost of a variety of grinding operations, like the one shown at the left, by replacing old equipment with new CINCINNATI FILMATIC Plain Hydraulic Grinders.

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a) Grinding wheel spindle bearings are FILMATICS. They are dependable . . . require no adjustment, and run for years without attention.

b) Accurate table reversal within .004"; for safely grinding close to shoulders.

c) Two-speed manual table and cross traverse; for convenience in setting up the machine.

d) Single START-STOP lever for coolant flow, headstock spindle rotation and table traverse; reduces operating fatigue.

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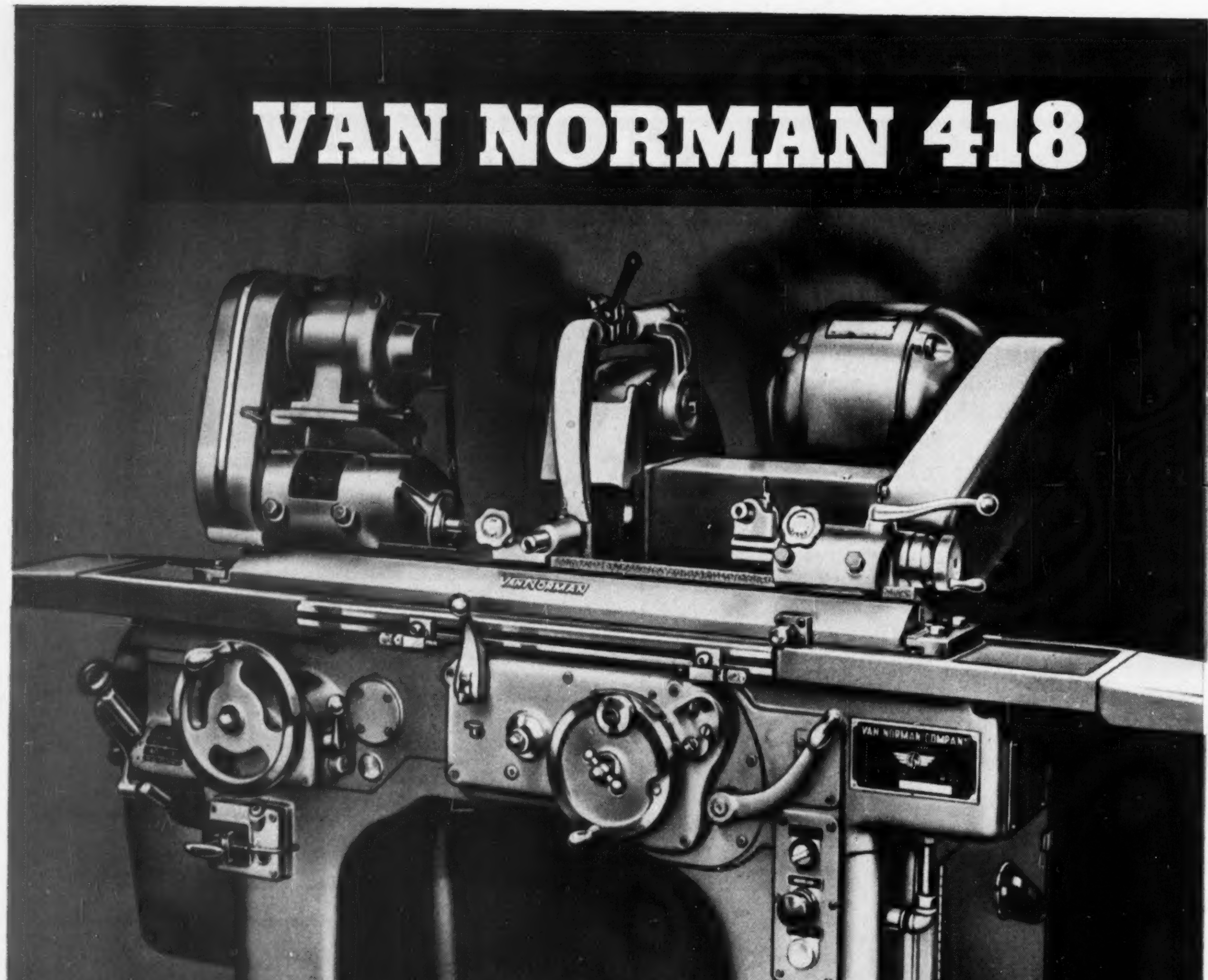

VAN NORMAN 418
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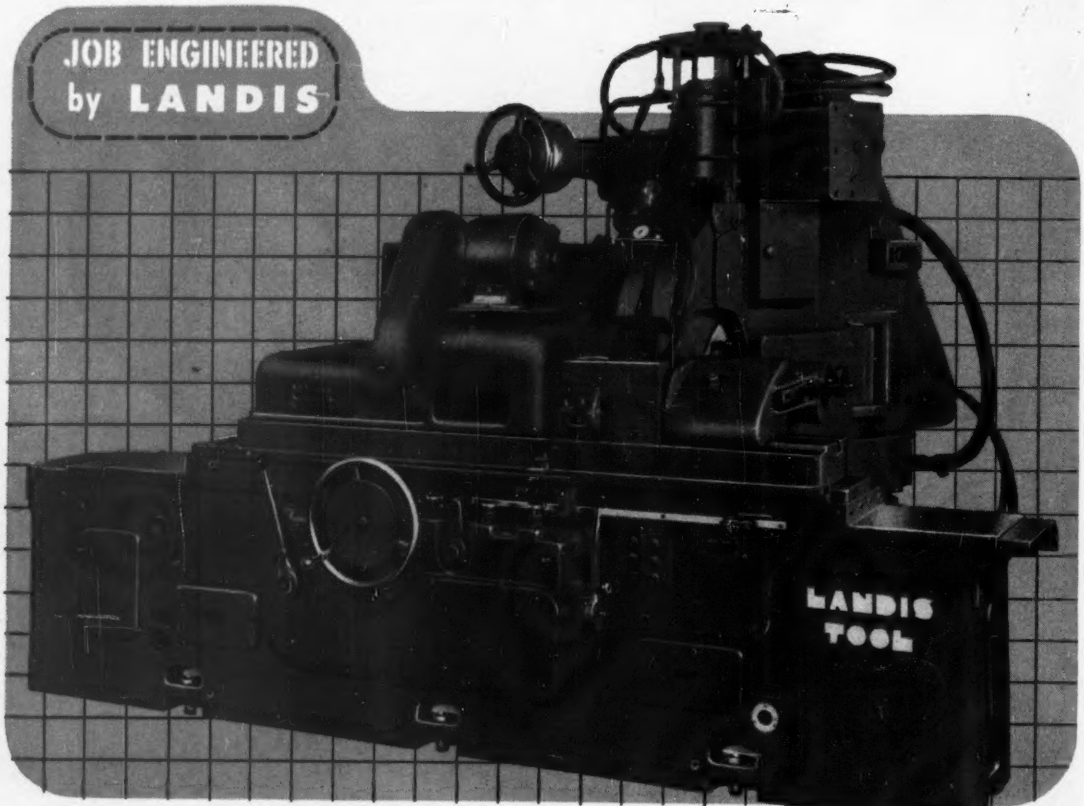
How LANDIS JOB ENGINEERING cuts grinding costs...

Angle wheelbase grinder gives fast return on investment...

Grinds diameters and adjoining face in one operation



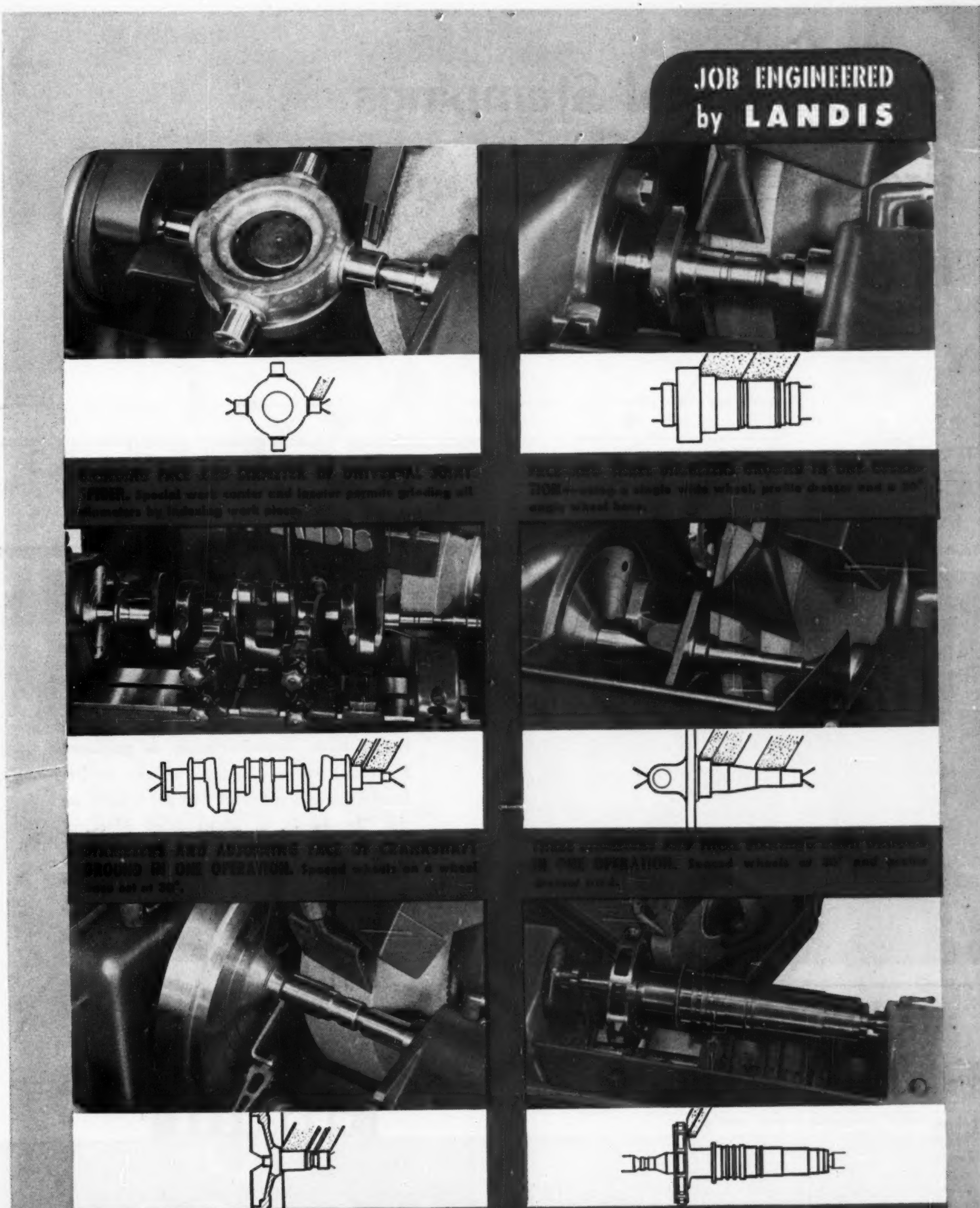
Landis 10" x 36" Type CH Plain Grinder with wheelbase set at 30°. Dresser is overhead type, hydraulically operated for profile dressing of wheel.

JOB ENGINEERED by LANDIS means grinding ideas that will produce the highest return on your investment —fast! It starts with operator convenience, hydraulic operation and simplified maintenance of a standard grinder. Then, on the basis of your requirements of
163 finish, tolerance and production, we will suggest tooling such as these angle wheelbase jobs that will increase output with no loss in precision or finish.

Landis Job Engineered Grinders give you fast return on your investment because they're engineered to your requirements. Send us your prints for tooling suggestions and production estimates. No obligation.

LANDIS

precision grinders



JOB ENGINEERED
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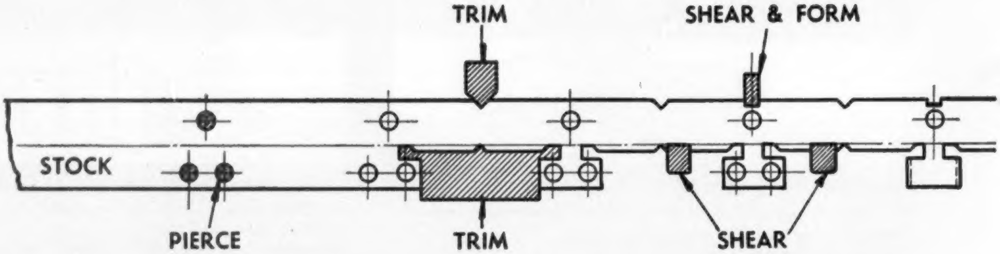
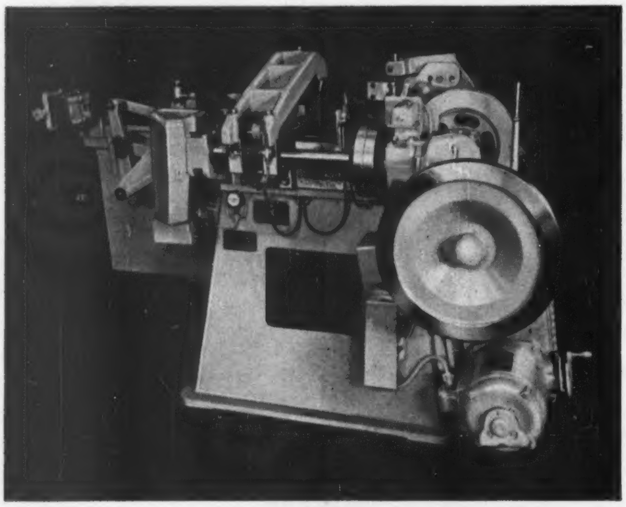
LANDIS TOOL COMPANY • WAYNESBORO, PENNSYLVANIA, U. S. A.

Formed Metal Stampings Produced Complete in the U. S. Eliminating Secondary Operations





The electrical part shown in ACTUAL SIZE above, opposite page, is produced from coil stock—complete, without further handling—at a speed of 140 per minute on the No. 28 U. S. Multi-Slide® Machine. Another example of the advantages of the Multi-Slide Machine for the precision fabrication of many types of metal parts calling for piercing, blanking, forming, swaging and embossing operations!

The part illustrated is made of phosphor bronze .025" thick, and the sequence of

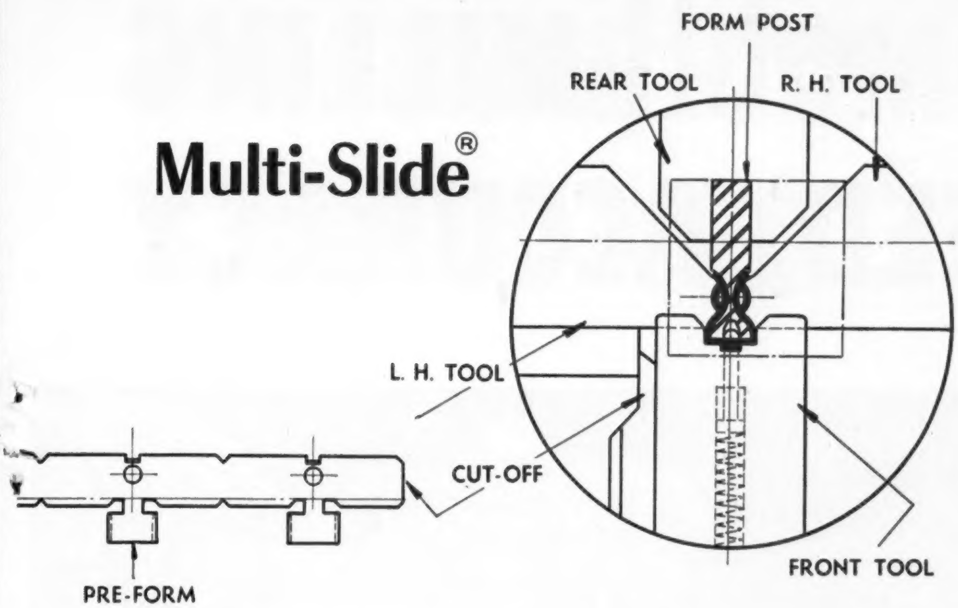
SIZES AND SPECIFICATIONS U. S. MULTI-SLIDES

Machine Size	#11	#28	#33	#35
Length of Feed	3"	8"	12½"	12½"
Maximum Width of Stock	¾"	1½"	2½"	3"
Overall Size	44x40x66"	50x38x80"	54x49x120"	57x55x147"
Net Weight	1090#	2600#	5900#	9560#
Crated Weight	1290#	3000#	6300#	10230#
Motor Recommended	1½ HP	2 HP	5 HP	7½ HP

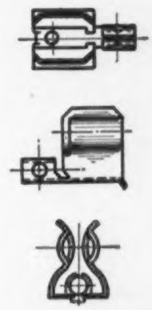
US PRODUCTS

U.S. TOOL

Multi-Slide®



ACTUAL SIZE OF METAL STAMPING



operations is as follows: pierce 3 holes; trim top and bottom; shear and bend on top, shear on bottom; preform; cut off; finish form. This operation is shown in detail in the profile view within the circle.

The photograph at the left shows a No. 28 Multi-Slide Machine similar to the one used for this work. Multi-Slide Machines are made in four standard sizes to accommodate stock of various widths, thicknesses and feed lengths. Capacities for each size are detailed in table below the machine illustration. These machines save manpower, too—a single operator can attend to a battery of Multi-Slides, since operation is entirely automatic. Operator merely loads coils of material onto stock reel for feeding into machine.

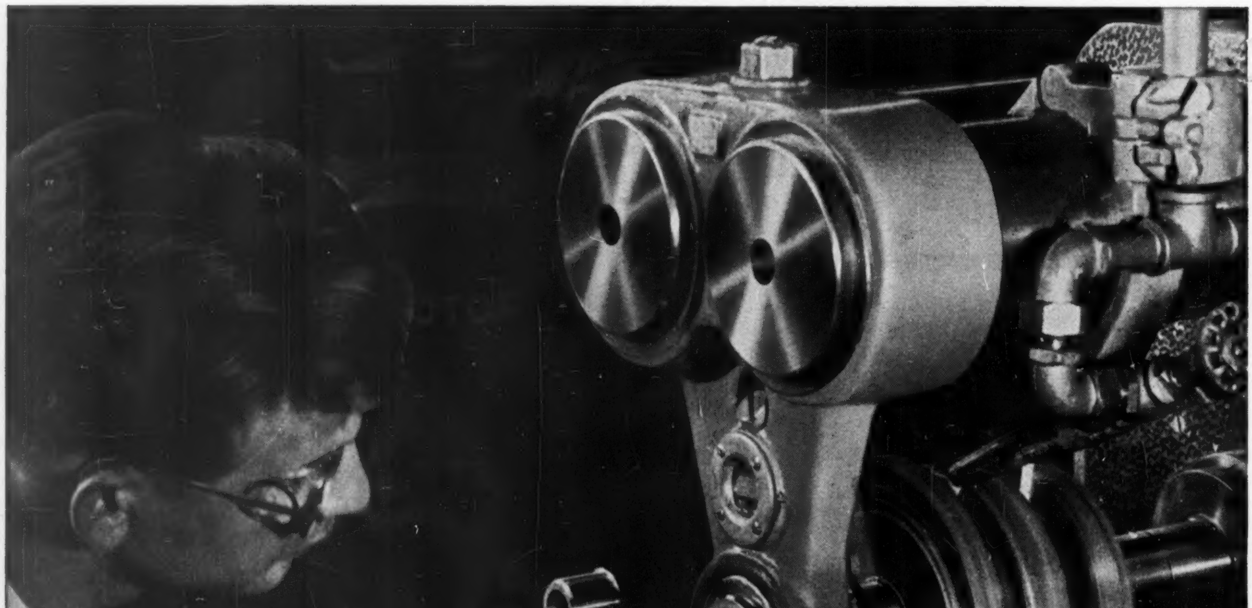
Perhaps some of the formed metal parts produced in YOUR plant could be handled to greater advantage on the U. S. Multi-Slide. Bulletin M15 contains complete details, and your inquiries are invited.

® Trade Mark Registered—U. S. Patent Office

COMPANY, Inc. AMPERE (East Orange) NEW JERSEY

Builders of U. S. Multi-Slides—U. S. Multi-Millers
U. S. Automatic Press Room Equipment—U. S. Die Sets and Accessories

CH MILLING SPEED, ACCURACY



Here's a job handled on a new CH-4 Machine

Job: Menasço Mfg. Co., Burbank, Calif. — Straddle Milling Drag Links

Machine: No. 4, Model CH, Plain Style

Part: Shock strut for landing gear cylinder

Cutters: High speed steel inserted tooth

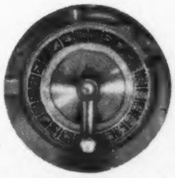
Cutter Speed: 18 rpm, $\frac{15}{32}$ ipm feed

Chip Load: .005"

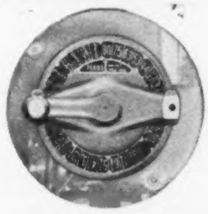
Material: 4140 Steel forging, 43 Rockwell

MACHINE COMBINES AND POWER

CH MILLING MACHINE FEATURES THAT HELPED DO THIS JOB BETTER

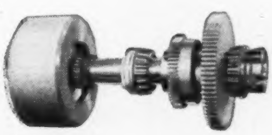


Speed range—*24* speed changes are provided from *15* to *1500* rpm. Automatic protecto-mesh mechanism permits nonclash shifting during speed changes.

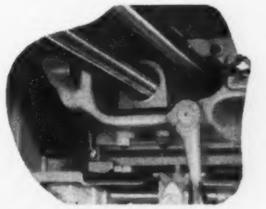


Extra wide feed range — *32* changes from ⅜" to *90"* per minute meet requirements of new metals and cutting tools for most efficient operation.

Greater rigidity — Entirely new column . . . heavily ribbed, box section, sponson construction . . . absorbs vibration from heaviest cutting loads.



Greater cutting efficiency through design refinements and a train of heavy duty, wide-faced, forged steel gears, hardened and specially processed for quiet operation.



Smoother feed performance through a heavy duty *2"* dia. table feed screw. *23%* greater bearing contact between screw nut for longer screw life and accuracy.

Greater horsepower through independent drives for spindle, feed and rapid traverse, and coolant. 15 hp delivered to spindle . . . *3* hp for feed and rapid traverse . . . ¼ hp for coolant.

INVESTIGATE the new CH line of milling machines. These and other features are job proven to give you cost-cutting results plus greater productivity, better finished products. Contact our nearest representative or write: Kearney & Trecker Corp., 6784 W. National Avenue, Milwaukee 14, Wisconsin.

KEARNEY & TRECKER
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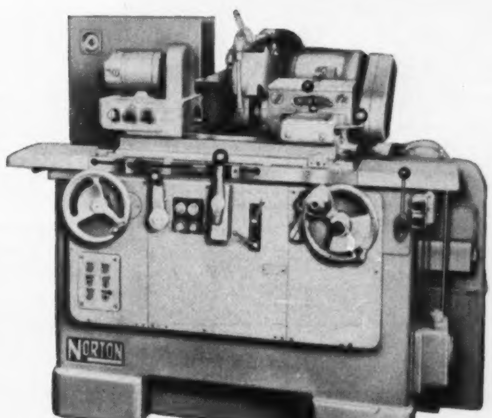
MACHINE TOOLS


NORTON

SMALL PARTS PAY OFF BIG . . . WITH THIS

"TOUCH OF GOLD"

The new Norton 4" type CTU Cylindrical Grinder gives you high precision plus high production



Here's a cylindrical grinder you can get as either a Plain Machine for traverse work, or as a Semiautomatic for plunge operations — in 12" or 18" work length capacities in both models.

Either way you'll get the added "Touch of Gold" by faster, more accurate, more profitable grinding of a wide variety of small parts. Because either way the 4" Type CTU's Norton-developed features bring a new ease of operation for your men — and a new high in production quality and quantity for *you*.

To name just one of these advanced features, there's the extremely rugged wheel spindle unit that assures enduring precision in jobs ranging from heavy stock removal to fine finishing. But why not get the whole story of this speedy, profit-boosting grinder from your Norton Representative?

Write for Catalog No. 531. And remember: only Norton offers you such long experience in both grinding wheels and machines — your assurance of the value-adding "Touch of Gold" that means better products at lower cost. NORTON COMPANY, Worcester 6, Mass.

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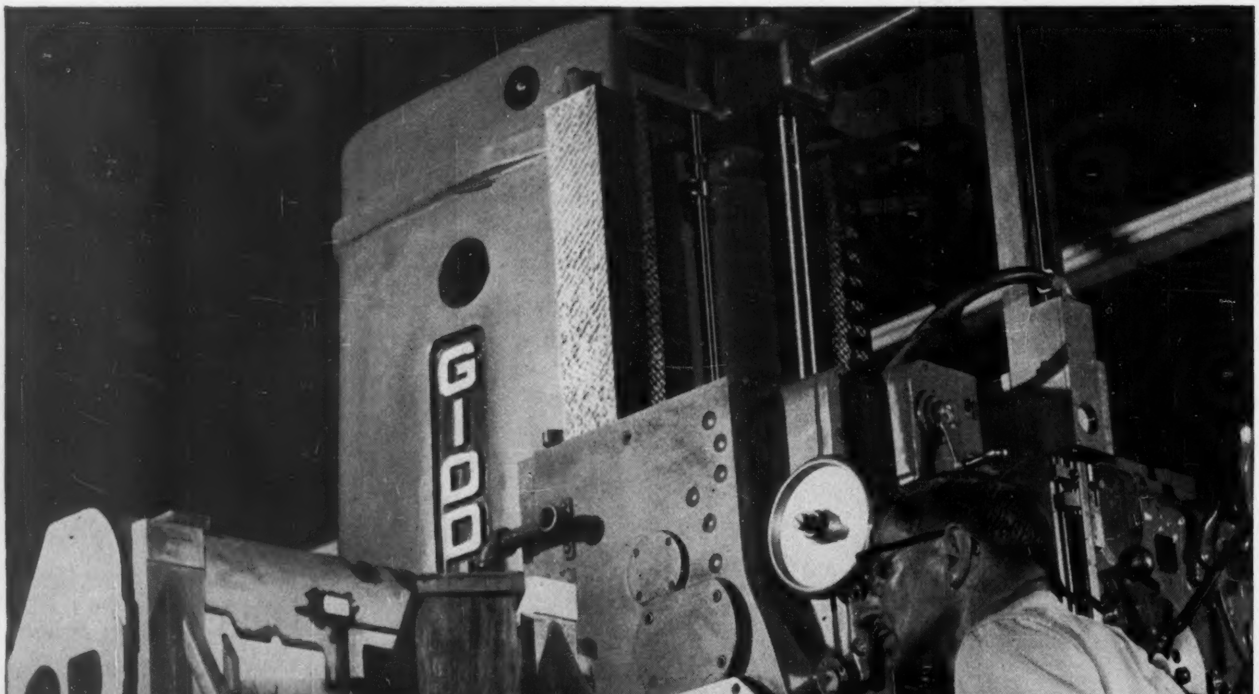
Automatic positioning production-machine



A range finder housing mounted on the G&L 340-T's table. Automatic Electric Positioning Device provides positive, automatic machine settings to extremely close limits.

...a new low cost way to ultra precision parts

Here's an exciting report from a producer of optical instruments. They're production-machining jigs, fixtures, prototypes and parts to .0002" tolerances on a G&L Horizontal Bar with an Automatic Electric Positioning Device.

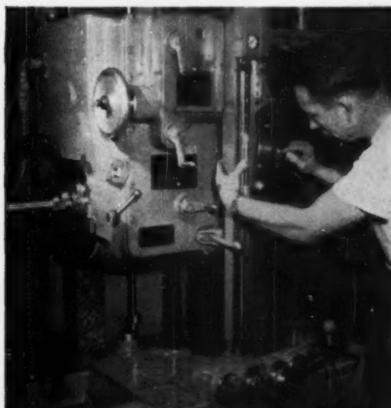
E. E. Jeffery, Supt., Production Engineering, Anaheim Division, Northrup Aircraft, Inc., reports a G&L 340-T Horizontal Boring, Drilling and Milling Machine with an Automatic Electric Positioning Device is pioneering a highly efficient new method of production-machining delicate precision parts. The machine performs multiple operations from a single setup . . . positions and repositions the workpiece *automatically* . . . holds tolerances well within .0002"!

For example: To complete an optical range finder housing, pre-determined settings are made with measuring rods and micrometer. After the casting has been set up, the Electric Positioning Device operates to precisely these limits, mechanically controls all table and headstock movements from there on in. Tolerances on this operation are held to ± .0005", parallelism to .001" per 4'.

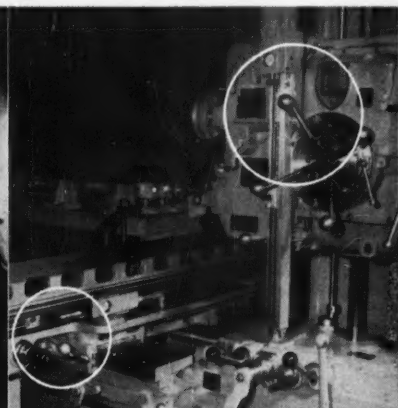
In addition, Northrup also uses the versatile 340-T to handle jobs on which the production rate does not warrant special machines or special tooling. Some of the work is performed in areas using the full length of the machine's table travel. But even with the table extended, extreme accuracies are consistently maintained.

In a leading technical trade journal, Mr. Jeffery wrote, "We've found the 340-T furnishes faster cutting speeds, heavier cuts, better finishes, greater accuracy and improved operating economy. Its speed and feed ranges are so well designed that it can provide excellent performance for an overall range of milling, drilling and boring practices in all ferric and non-ferric materials."

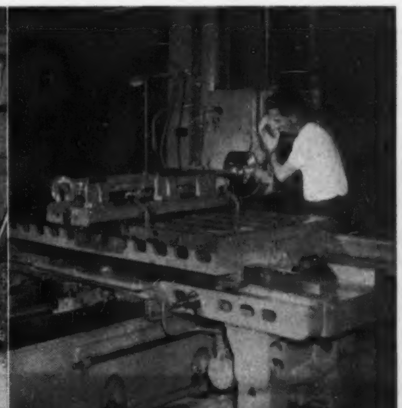
To get all the facts on this G&L machine, with the Automatic Electric Positioning Device, or the complete line of precision-plus G&L machine tools, contact your G&L representative or write direct.



The operator adjusts the standard precision and measuring rods and inside micrometer in vertical trough on headstock.



Circles show location of positioning device for both headstock and table travel. Automatic, control of table and headstock movements eliminates time-consuming, fine hand-adjustments in locating work.



Here operator sets up one of the larger workpieces. It will be bored for a 2" diameter hole—tolerances ± .0005".

Builders of the world's finest Horizontal Boring, Drilling and Milling Machines — table, floor and planer types; Hypro Planers, Planer Type Milling Machines and Vertical Boring Mills; and G&L tool accessories.

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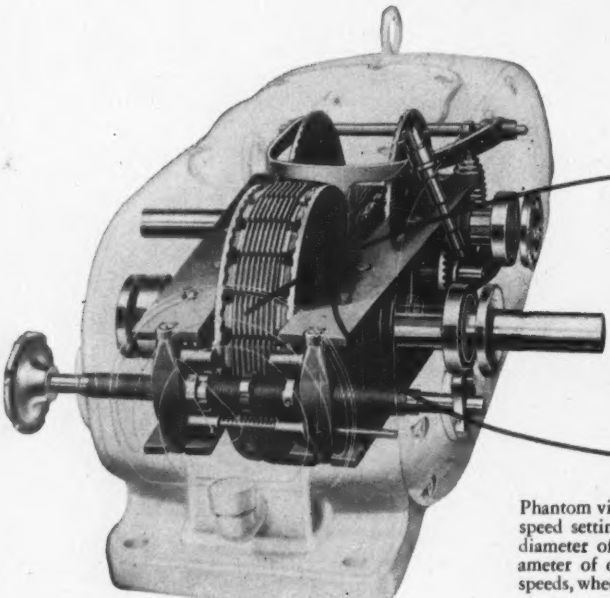
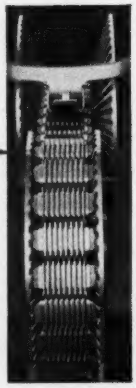
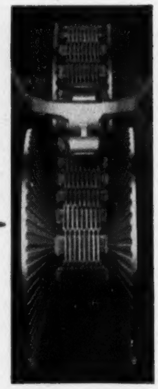
Fond du Lac, Wisconsin, U. S. A.

How you can get speed changing that's

truly POSITIVE truly STEPLESS







ALL INDUSTRY USES P.I.V.*

***Positive, infinitely variable**

Phantom view of P.I.V. shows maximum speed setting. Chain engages maximum diameter of input wheel, minimum diameter of output wheel. For minimum speeds, wheel settings are reversed (right).

LINK-BELT's P.I.V. operates independent of friction ... gives you exact selection of an infinite number of speeds

TURN a hand wheel . . . push a button . . . or utilize fully-automatic controls. Link-Belt's P.I.V. Variable Speed Drive provides the speed you need—without stopping the machine. Speed changing is positive, stepless—accurate under full load. Speed choice is infinitely selective, effortless and precise.

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If your manufacturing processes demand variable speed control, get all the facts about these compact P.I.V. Variable Speed Drives. There's an experienced power transmission engineer in the Link-Belt office near you. Call him today. Send for Catalog No. 2274.

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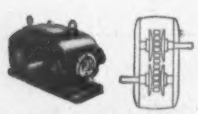
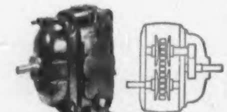
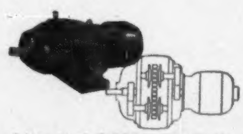
4 of 16 P.I.V. types you can choose from. 1/2 to 25 hp ... ratios to 6:1



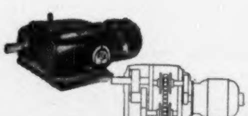
Basic P.I.V. Like all others, it is built for horizontal or vertical mounting.



P.I.V. with single reduction input or output helical gears.



Motorized P.I.V. with single reduction input and output helical gears.



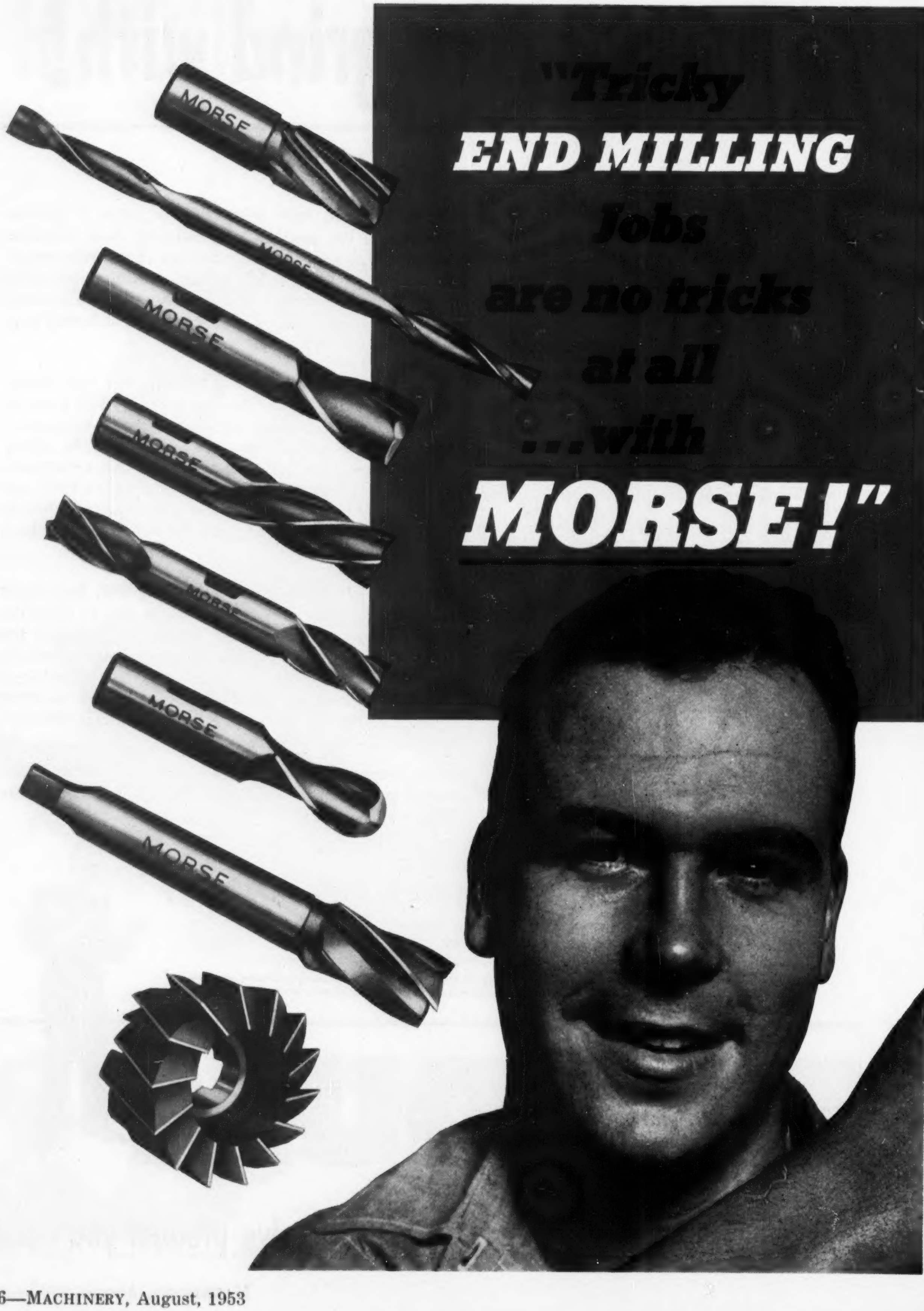
Motorized P.I.V. with single reduction input and double reduction output helical gears.

If YOU've got it to grind...

CARBO

TRADE

"Carborundum" is a registered trademark which indicates manufacture by The Carborundum Company, Niagara Falls, New York


"Tricky
END MILLING
Jobs
are no tricks
at all
...with
MORSE!"

A lot of *standard* Morse End Mills would be specials in anybody else's catalog!

Want them short and stubby, or long and lean? Or with ball-end for die cavities, fillets, and round-bottomed holes and slots? Or with *left*-hand spiral but *right*-hand cut to push chips ahead? Morse makes all these, *and more . . .*

For instance, Morse also makes them with two flutes, cleared to cut to center for plunge-cutting . . . with taper shanks to fit machine spindles . . . and in shell types for face or slab milling cuts. Not to mention a complete size-range in the exclusive shear-cutting design known as Morse Hi-Helix.

So if you want an end to your end-mill problems, get hold of your Morse-Franchised Distributor. He has every type you could possibly need . . . and he knows how to engineer it to your job. *Call him now.*

MORSE TWIST DRILL & MACHINE COMPANY

NEW BEDFORD, MASSACHUSETTS

(Division of VAN NORMAN CO.)

Warehouses in New York, Chicago, Detroit, Houston, San Francisco

MORSE

Cutting Tools

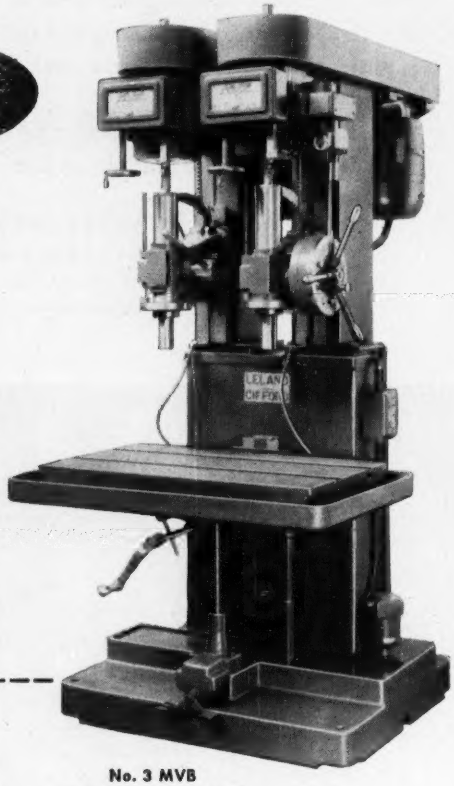
Buy them by phone from your Morse-Franchised Distributor . and save ordering time

fertile field for cost cutting....

Think of all the HOLES you drill per year

If you want to save money, start where the chances are best . . . *with your drilling operations!* Even a slight reduction per hole adds up fast when you think of the holes you drill per year. But these new Leland-Gifford drilling machines will give you much more than a "slight" reduction. They're miles ahead of anything built twenty, ten or even five years ago.

Fast, powerful, rugged yet sensitive, each is capable of handling a wide range of work. All have new features that make for easier operation, faster work handling, greater accuracy and quicker adaptability to changing production requirements.



No. 3 MVB
Holes from ¼" to 1½"
24" Swing.1 to 4 Spindles

No. 1 LMS
Holes from
No. 80 to 5/16"
12" or 20" Swing
1 to 6 Spindles

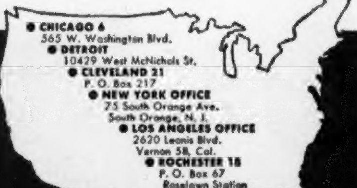
No. 2 LMS
Holes from 1/16" to ¾". 20"
or 26" Swing.1 to 6 Spindles

If you drill precision holes, you can't make a more profitable investment than new Leland-Gifford Drilling Machines. Write for complete information.

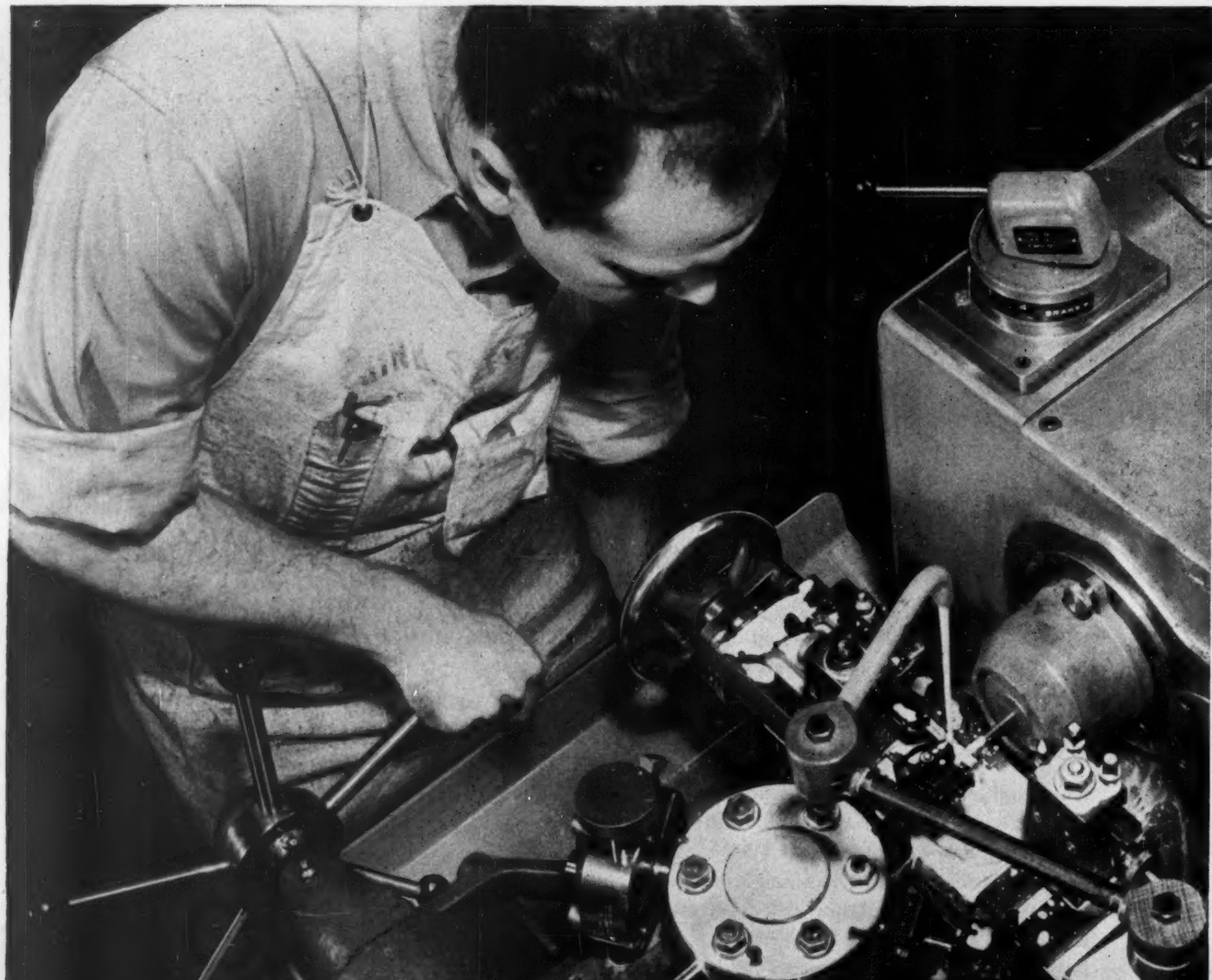
LELAND-GIFFORD

Drilling Machines

WORCESTER 1, MASSACHUSETTS, U.S.A.

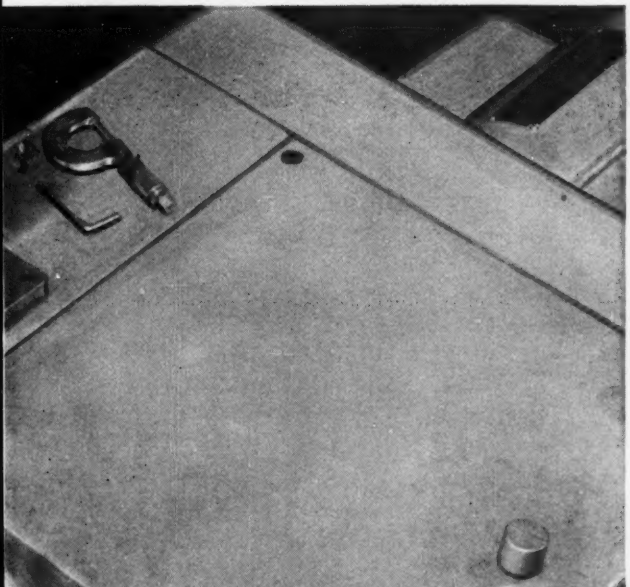


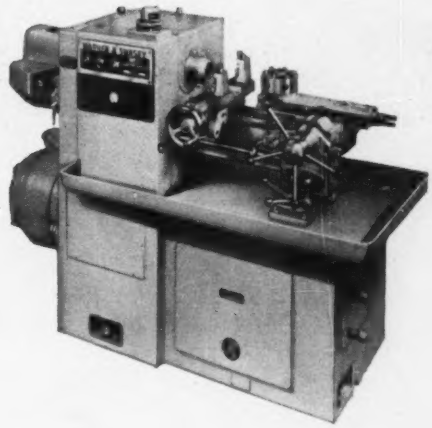
NOW! a small capacity turret and alloy steels more



YOU CAN PRODUCE IT BETTER, FASTER, FOR LESS WITH WARNER & SWASEY

lathe that turns stainless accurately than ever before!





NOW, FOR THE FIRST TIME, all the versatility of a larger turret lathe has been incorporated in a No. 1 model—the Warner & Swasey No. 1 Electro-Cycle. It is easy to operate and control, designed to meet the high speed requirements of many small diameter bar jobs—to provide plenty of cutting torque at low speeds even for turning and threading hard steels.

Also for the first time, the new No. 1 E-C gives you power feed to turret, a decided advantage in turning high precision jobs involving stainless or alloy steels. This feature, combined with the 1 E-C's wide range of spindle speeds, enables you to make the most efficient use of tools—providing better, more uniform finishes whether you're turning plastics, brass or hard steels.

And like all Warner & Swasey Machine Tools, the No. 1 E-C is ruggedly built to provide the rigidity necessary for lasting accuracy. You'll find it a profit builder on your small bar jobs, in a wide range of lot sizes. So call in your nearest Warner & Swasey Field Representative for all the facts!

WARNER & SWASEY
Cleveland
PRECISION MACHINERY SINCE 1880

MACHINE TOOLS, TEXTILE MACHINERY, CONSTRUCTION MACHINERY

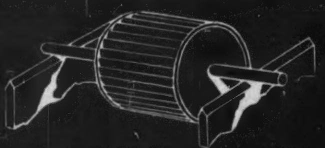
How times have changed!

for instance:

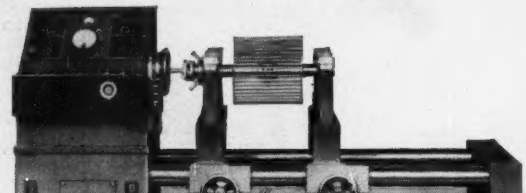
This was transportation .... **NOW** this is it.

This was the best cleaner .... until we got **THIS.**

The old rub-a-dub washdays .... gave way to **THIS.**



This was a balancer ...... **until we built THIS!**



Type 3-U Balancer

Any job worth doing is worth doing *right!* And with today's precision manufacture and high-speed rotating parts, that applies to balancing more emphatically than ever.

If your work involves balancing, do it the *modern* way—with Gisholt DYNETRIC Balancing Machines. Here's unrivaled speed that enables you to locate and measure unbalance in a matter of seconds—unequalled accuracy, capable of detecting vibrations as small as .000025".

Gisholt Balancers are available for handling all kinds of rotating parts, from a fraction of an ounce to many tons. Write us for a copy of the booklet STATIC & DYNAMIC BALANCING.

DYNETRIC BALANCERS

GISHOLT MACHINE COMPANY

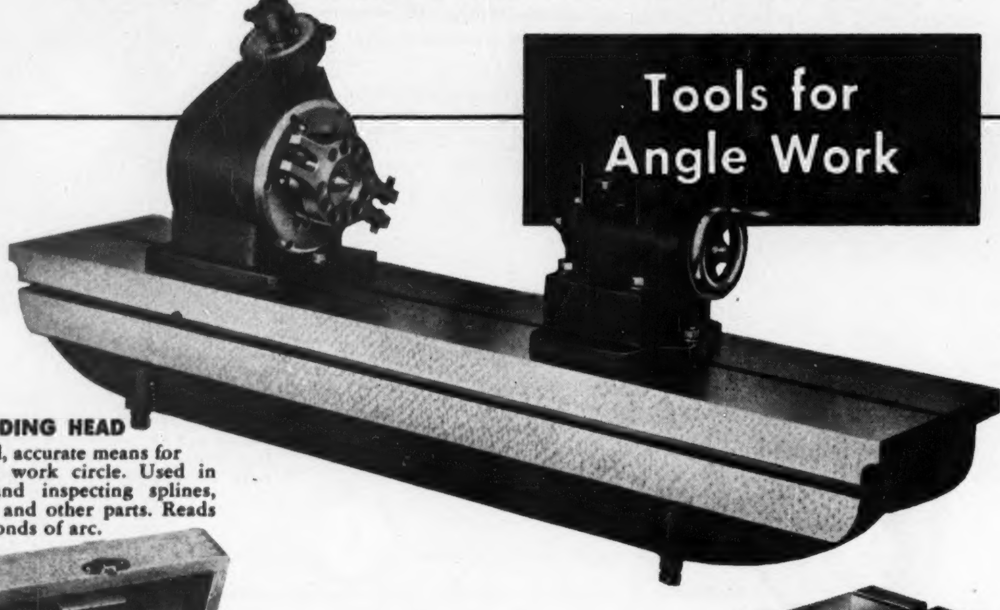
Madison 10, Wisconsin

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

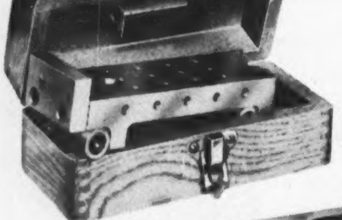
Increase Production Range and Capacity

with these
TAFT-PEIRCE Specialties for Precision Work

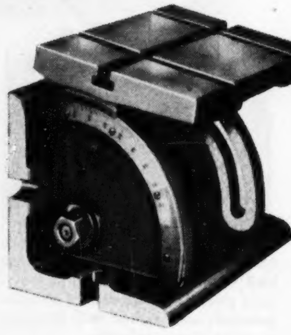
Tools for Angle Work



T-P DIVIDING HEAD
offers a rapid, accurate means for dividing the work circle. Used in measuring and inspecting splines, gears, cams, and other parts. Reads within 6 seconds of arc.

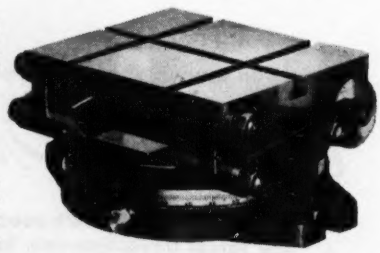


T-P SINE BARS & SINE BLOCKS
First conceived and built by Taft-Peirce, they locate work to any given angle within very close limits. Tapped holes permit clamping.



T-P TOOLMAKER'S ADJUSTABLE KNEE
simplify inspection or setup of angular work. Graduated quadrant and vernier reads to 5 minutes of angle.

T-P ANGLE BLOCKS
speed setup and grinding of small angular work on a magnetic chuck. Can be used individually or in any combination to form V-blocks.



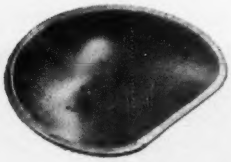
T-P ADJUSTABLE ANGLE PLATE
tilts and turns. Makes compound angles easy to setup for machining. Both tilting table and rotating base are graduated from 0 to 90 degrees in each direction.

PRODUCTION TIME CUT IN HALF

4 single stage dies are involved in stamping the farm tractor seat pan shown . . . but only 2 stamping operations are necessary instead of 4. 2 operations are performed at one stroke. Dies are mounted two at a time to produce 300 pieces per hour—cutting production time in half!

a DANLY PRESS *does it!*

FOR WISCONSIN METAL PRODUCTS CO.



The addition of this 600-ton Danly Straight Side Press represents an important expansion of shop capacity for the Wisconsin Metal Products Co., of Racine, Wisconsin. It means far more than just another press because its 96 by 42 inch bed opens up a whole new field of operation in large stampings . . . and provides important "capacity insurance" for a wider variety of jobs.

Exclusive Danly Press features mean lower stamping costs too. Automatic *oil* lubrication decreases maintenance requirements . . . the Cool-Running Clutch wears longer, reduces down-time . . . greater structural rigidity assures less vibration and bed deflection, increases die life. Whatever your requirements, there's a Danly Press designed to increase *your* stamping capacity—for the TOUGH jobs.

DANLY MACHINE SPECIALTIES, INC.
2100 South Laramie Avenue, Chicago 50, Illinois

DANLY

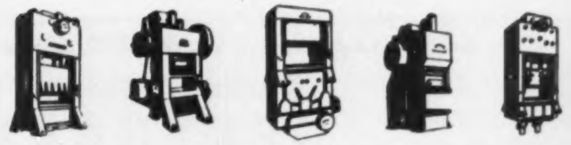
MECHANICAL PRESSES . . . 50 TO 3000 TONS

HYDRAULIC METALWORKING EQUIPMENT

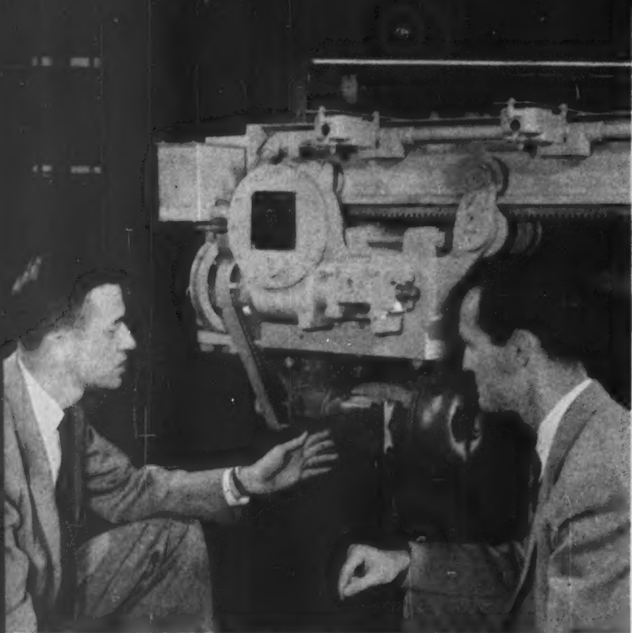
Send for this free Booklet today

. . . see how you can put Danly Presses to work in your plant for increased capacity at lower cost!

It costs less to run a DANLY PRESS



Single Action Straight Side | Autofeed | Underdrive Single, Double, Triple Action | Gap Frame | Double Action Straight Side



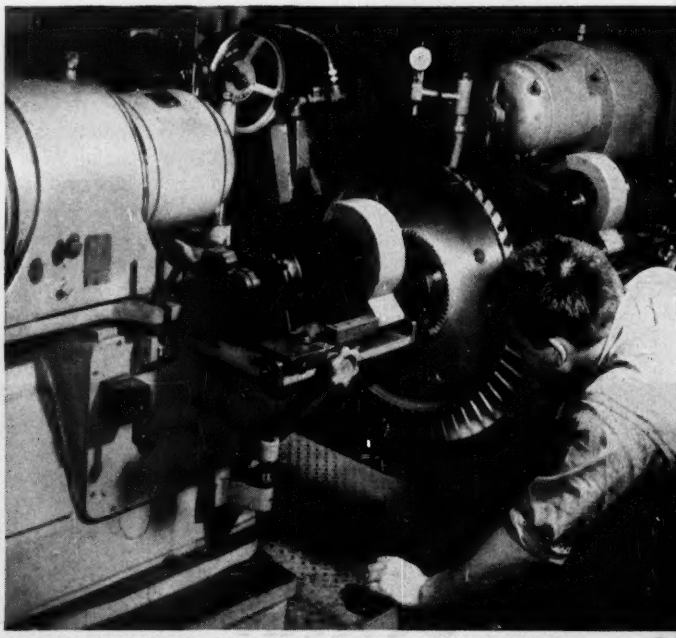
1 QUICK INSTALLATION SAVES YOU MANHOURS when G-E gear-motor is used on compact machines like this soot blower for power plant equipment. Neat, packaged construction permits quick, easy installation in limited space.

2 SIMPLE MAINTENANCE SAVES YOU MONEY. If electrical maintenance is ever needed on this G-E Tri-Clad gear-motor—driving scraper in a grannery—3-piece design will permit stator removal without disturbing gear train.

Save 4 Ways with G-E TRI/CLAD Gear-motors

REG. U.S. PAT. OFF.

3 PROMPT DELIVERY SAVES YOU TIME—assures you of getting the gear-motor you need when you need it. A new multiple point stock plan permits one-week delivery on more than 300 models of General Electric gear-motors.



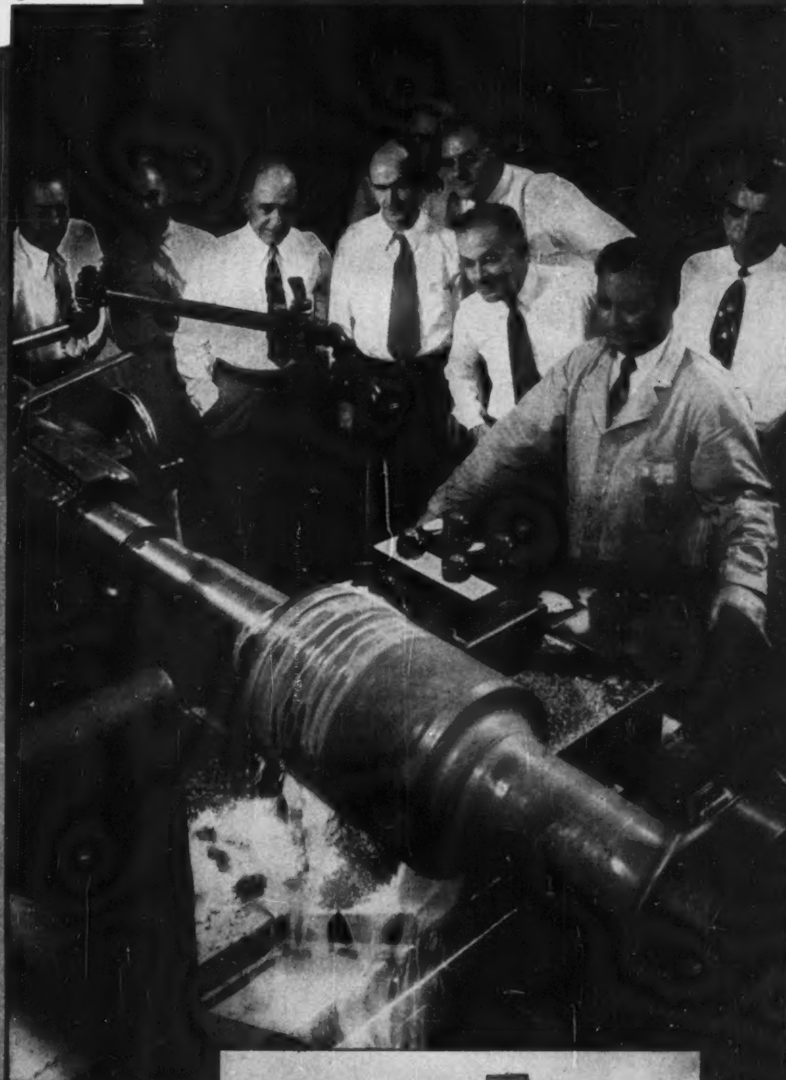
4 THE "RIGHT" GEAR-MOTOR SAVES YOU TROUBLE on precision operations like grinding jet engine bucket blades. General Electric's wide selection assures you of the correct gear-motor for your particular low-speed application.

For more information about G-E Tri-Clad gear-motors contact your nearest G-E representative, agent, or distributor, or write to General Electric Company, Section 755-12, Schenectady 5, N. Y. for your free copy of new Bulletin GEA-1437H.

GENERAL ELECTRIC

It MUST have been good!

There are times when expressions speak louder than words.

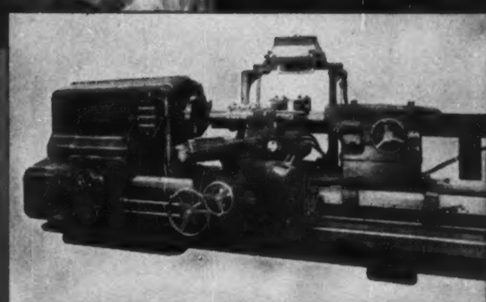


Here's a group of distinguished steel mill roll executives watching a demonstration on a 28" Capacity "AMERICAN" Hydraulic Roll Lathe—judge for yourself whether or not they are satisfied with what they saw.

These machines are performing "miracles" in savings in many of the best known roll shops in the country. They have introduced a brand new machining technique that has revolutionized the art of roll turning. They reproduce work shapes from a template faithfully and accurately not only on steel mill roll bodies and necks, but on such work as spindles, motor shafts, valve stems, step shafts, piston rods, axles and a wide variety of chucking work having irregular contours.

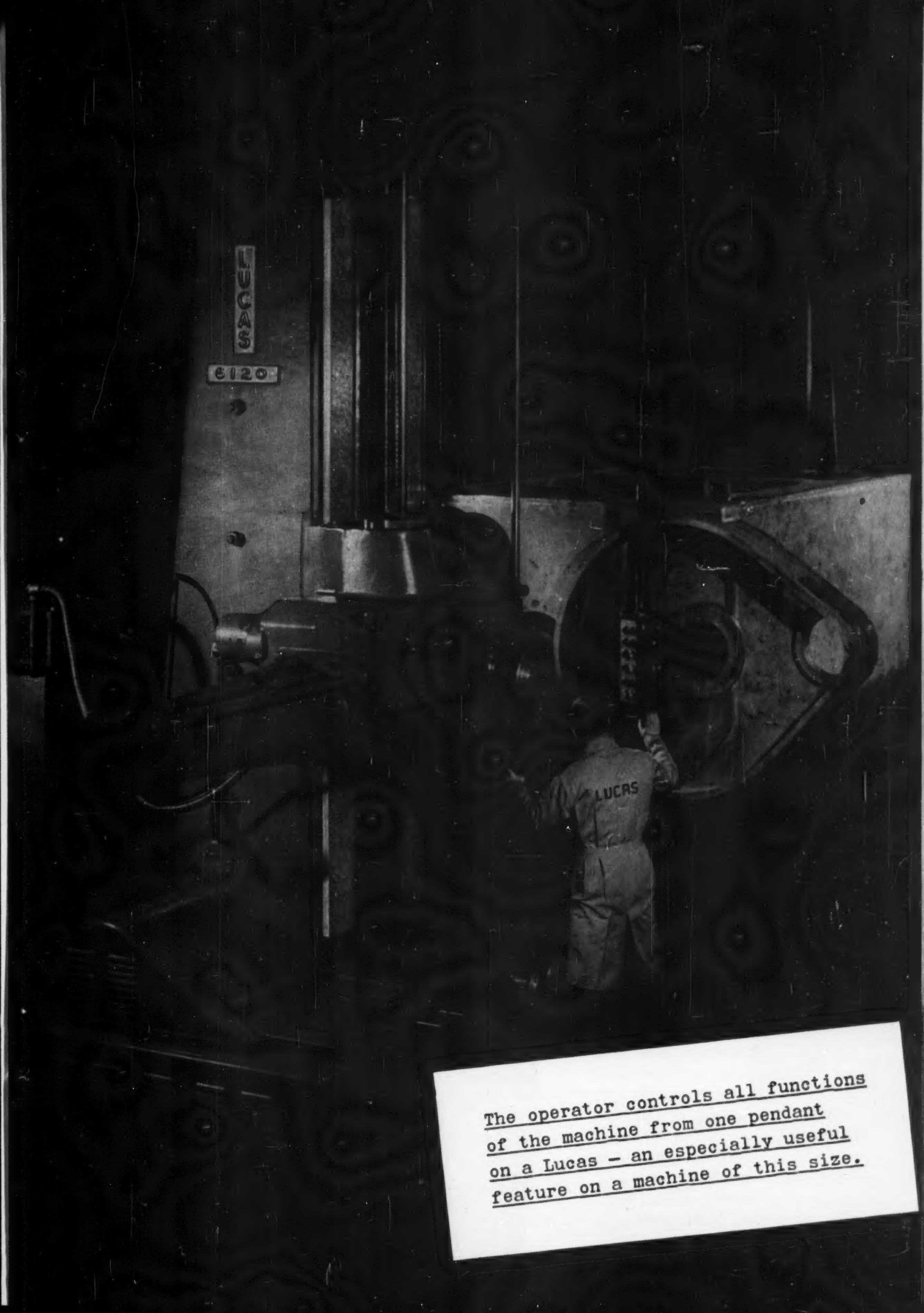
Evidence from hundreds of installations proves beyond a shadow of a doubt their leadership as top-flight cost reducers. Was there ever a time when cost reduction was more urgently needed?

If it's proof you want just drop us a line—no obligation.

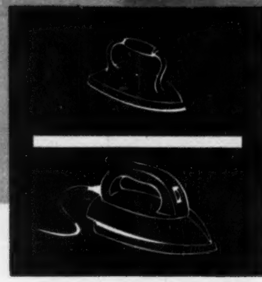


THE AMERICAN TOOL WORKS CO. Cincinnati 2, Ohio, U. S. A.

LATHES AND RADIAL DRILLS



The operator controls all functions of the machine from one pendant on a Lucas – an especially useful feature on a machine of this size.



Machines for Making Progress

When a manufacturer says sales are "so-so" today he is probably talking about a volume beyond his fondest dreams of a dozen years ago. But payroll, fringe benefits, taxes, material costs, and generally increased expense may have turned a period of booming sales into one of profitless prosperity.

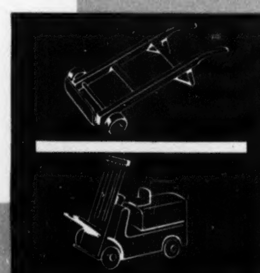
In such a situation a manufacturer's best friends are his machine tools. But such tools must be much more than mechanically sound — they must have the accuracy and productivity that 1953 standards demand, or they might just as well be worn out.

New Britains are *machines for making progress.* More important — they're *machines for making profits.*

AUTOMATIC BAR AND CHUCKING MACHINES
PRECISION BORING MACHINES
LUCAS HORIZONTAL BORING, DRILLING & MILLING MACHINES
NEW BRITAIN +GF+ COPYING LATHES

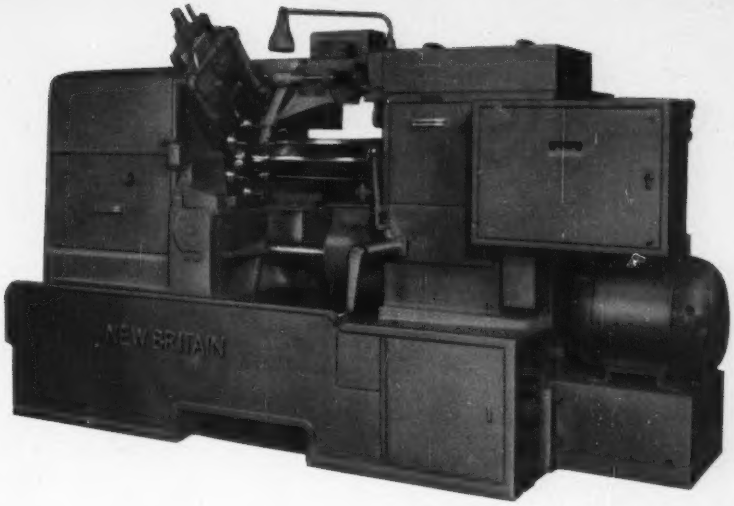
THE
NEW BRITAIN MACHINE COMPANY

New Britain-Gridley Machine Division
New Britain, Connecticut
Lucas Machine Division
Cleveland 8, Ohio



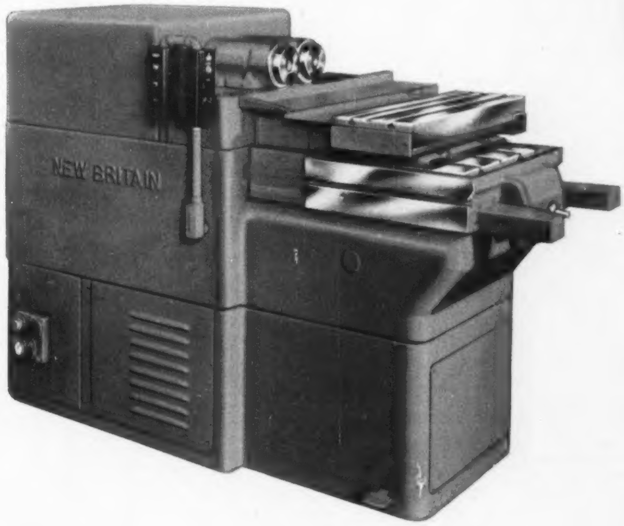
MODEL 61

New Britain builds a complete line of multiple spindle bar machines in a range of sizes up to 2¼" dia. Ruggedly built, they are capable of doing heavy duty jobs, running at high speeds and consistently holding close tolerances. These automatics with their time-tested, profit-producing features are constantly proving themselves in modern high production plants.



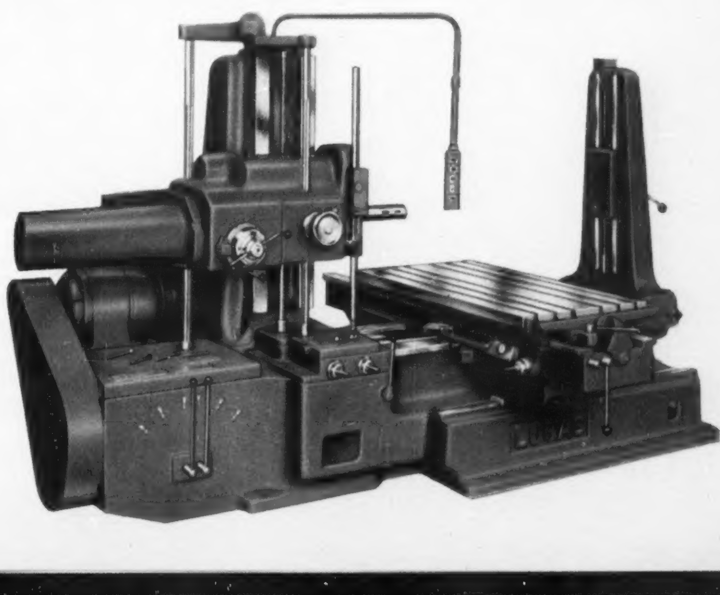
MODEL 37

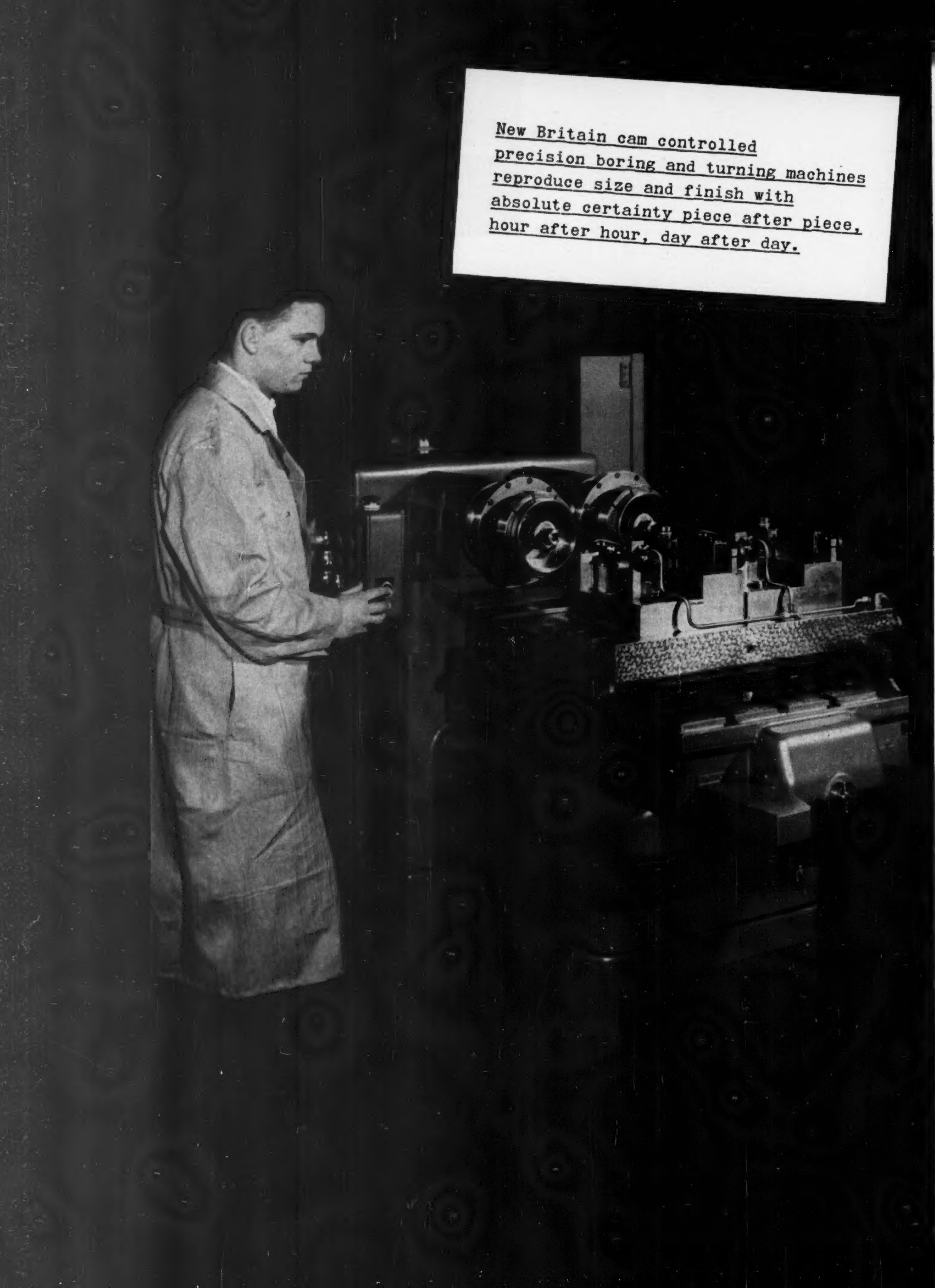
New Britain makes a complete line of cam controlled precision boring machines for both straight and contour work. Model 37, illustrated, generates all types of radii, chamfers, undercuts, grooves, faces, etc., plus straight boring and turning. A fast, accurate, positive, and simple machine, it reduces the manufacturing cost of a wide variety of sizes and types of pieces.



LUCAS Precision

A Lucas Precision Horizontal Boring, Drilling and Milling Machine will perform many operations in sequence on one piece or a thousand, from small components to large weldments like the one shown in the photo on the front side of this insert. It will not only make heavy roughing cuts but will also finish to the close tolerances required in today's precision manufacturing. It is quickly set up for short runs and incorporates Automatic Power Positioning for multiple operation work.





New Britain cam controlled precision boring and turning machines reproduce size and finish with absolute certainty piece after piece, hour after hour, day after day.

H.J.
Here's a really fantastic letter!
P.W.

BANNER TOOL COMPANY

BANNER TOOLS DETROIT

Fine TOOLS FOR INDUSTRY

7243 FILER AVENUE - TWINBROOK 2-4900

DETROIT 12, MICHIGAN

June 16, 1952

Cities Service Oil Co.,
3049 E. Grand Blvd.,
Detroit 2, Michigan
Attention: Mr. P. E. Watts

Dear Sirs:

We called upon the services of your lubrication engineer, Mr. A. J. Blake, in reference to a serious staining condition which we were having with our soluble oil. He analyzed this condition and recommended one of your Chillo Oils. This oil was tried and the rust condition eliminated to our satisfaction.

To our surprise on his next visit he was dissatisfied with our tool life and suggested we use a soluble oil called "Chillo A". Now not only do we have clean machines, but tool life has been increased 20%! While in our plant he asked permission to "look around", which, of course, was granted.

We were using a tapping compound with precision ground taps in order to hold to close tolerances. We did not consider tap breakage excessive but the removal of broken taps was sometimes rather expensive. He recommended we use "Chillo 10Z". Then came the surprise of our lives! With Chillo 10Z we have gone to commercial ground taps (a 300% savings) and can still hold our same tolerances, with a sharper thread, increasing tap life a minimum of 20% plus eliminating expensive removal of broken taps!

We also have a production stamping job which required a new set of dies every month. On his recommendation we tried Chillo 10Z with these dies. Now our die life has increased to at least two months...a saving in die life of 100%, disregarding labor costs. We also increased production 200% per die sharpening!

We tried the same oil on our broaching operation and found that instead of making two cuts we can get the same results now with one. We were using one of your competitors' hydraulic oils and you told us it was a "good oil" and would give us satisfactory performance. BUT, GENTLEMEN, WITH THE EXCELLENT SERVICE YOU HAVE GIVEN, PLUS THE TIME AND MONEY SAVED, YOU MAY REST ASSURED THAT ALL OF OUR LUBRICATING REQUIREMENTS WILL BE PURCHASED FROM YOU.

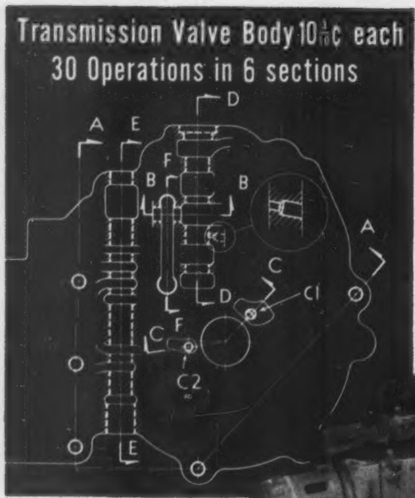
Yours very truly,
BANNER TOOL COMPANY

S F Olesak

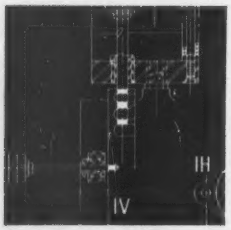
S. F. OLESAK

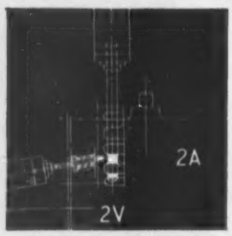
SFO:sd

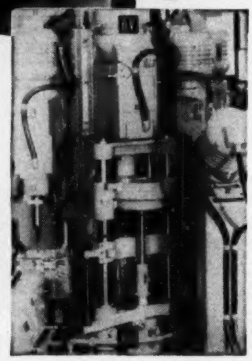

Red Shield says:
"STANDARD for tough jobs since 1881"
as near as your telephone
Call your Industrial Supply Distributor for Shield Brand End Mills. Specialized factory service available everywhere.
STANDARD TOOL CO.
3950 CHESTER AVENUE CLEVELAND 14, OHIO
STANDARD TOOL CO.
NEW YORK • DETROIT • CHICAGO • DALLAS • SAN FRANCISCO
THE STANDARD LINE: Twist Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools



Kingsbury give you







This Kingsbury central column machine has knees for mounting 3 Horizontal (H) Units and 8 Angle (A) Units. The central column mounts 11 Vertical (V) Units, one of which has two heads, one above the work and the other under it (U). Some of the units have multiple spindles. The 60-inch index table has 12 stations — one for loading and unloading.

The machine performs 30 operations: drilling, c'boring and reaming. Some of these are illustrated below.

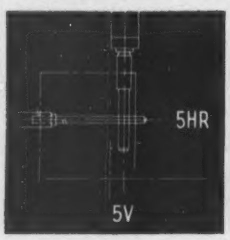
This Kingsbury produces 176 pieces per hour gross at an average cost of 10.26¢ per piece.

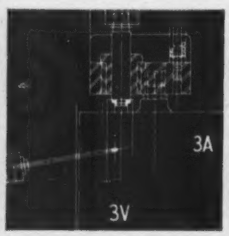
Follow this Transmission Valve Body

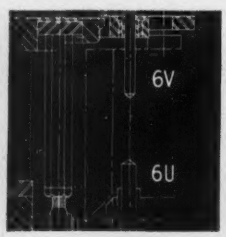
Section A: Unit 1H .281 drill — 5 thru-holes.

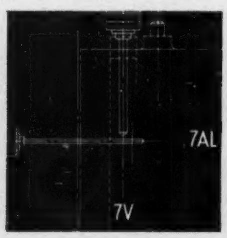
Section DD: Five vertical and three angle units prepare this long valve hole thru five walls. It must be straight, accurate, parallel with Section EE, and finished ready for borizing. Unit 1V .437 drills thru three walls; Unit 2V .437 drills thru the fifth wall. Units 4V and 5V rough- and semi-finish step-ream the hole. Unit 3V step-c'bores .812 and .640 at entrance to hole.

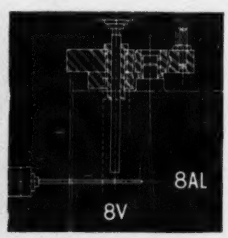
Angle units finish the port at the fourth wall. Unit 2A .156 drills 15/64 deep; Unit 3A .096 drills thru and Unit 10A .1115 reams this hole.











Special Purpose Machines are custom-built to high production at low cost

Units of 1/2 to 5 hp drill, ream, c'bore, mill, tap, thread — all accurately and economically

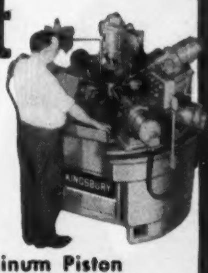
Operations are combined to insure accuracy, speed production, save money. The piece is chucked only once. It travels through the machine cycle, stopping successively at stations where Kingsbury Units complete their operations within predetermined time limits. At some stations several units work on the piece simultaneously. The operator loads and unloads the machine — there is no rehandling. Accurate machining reduces scrap. And think of the floor space saved!

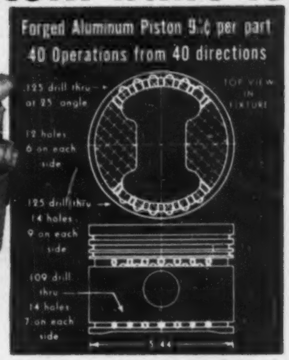
If you have a suitable piece which requires a combination of these machining operations, it will pay you to investigate a Kingsbury. We can tell you whether or not we could develop a machine to make the piece in quantity at satisfactory cost. In fact, we would not tackle the job unless we could!

Kingsbury Machine Tool Corp.
102 Laurel Street, Keene, New Hampshire

KINGSBURY

AUTOMATIC DRILLING AND TAPPING MACHINES
for Low-Cost High Production





Forged Aluminum Piston
60 Pieces per Hour Gross — 9-9/10¢ per Piece

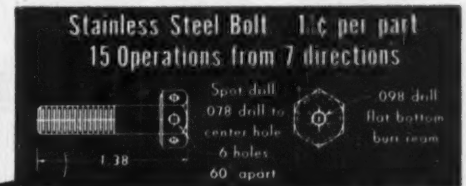
This compact machine has a 60-inch base with 6 units mounted around a central work fixture. Operator loads the part, trips a valve and watches the machine go through an automatic cycle that takes 41 seconds.

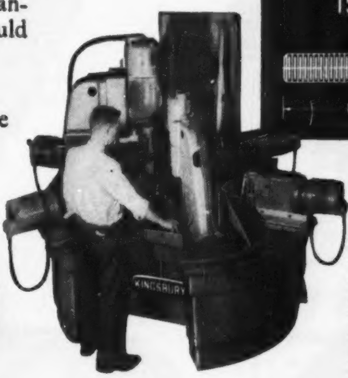
The piston indexes on its own axis. First index 26° 15′, then 5 indexes of 14° each to complete 12 angular holes in upper ring groove. Heads 1A & 4A do this work.

Next index 16° then 1 index of 18° and 5 indexes of 14° complete 14 horizontal holes in lower ring groove. Heads 3H & 6H do this work.

Next index 43° 30′, then 6 indexes of 15° to complete 14 horizontal holes in upper ring groove. Heads 2H & 5H do this work.

Now index 26° 15′ to bring work to loading position. Machine stops automatically, job is finished.





Stainless Steel Bolt
460 Pieces per Hour Gross — 1-9/10¢ per Piece

On an 80-inch diameter base, four horizontal and two vertical units spot drill, drill thru, flat-bottom and burr-ream as required. The 12-inch index table has 12 work fixtures, and each rotates clockwise. Work fixtures rotate 90° when the table indexes 30°. Bushing carriers insure accuracy.

through 30 operations — with only one chucking

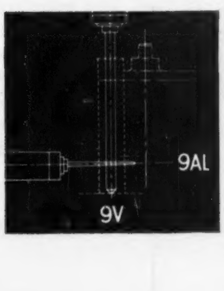
Section EE is another long valve hole thru nine walls, prepared for borizing. Vertical units perform 7 operations.

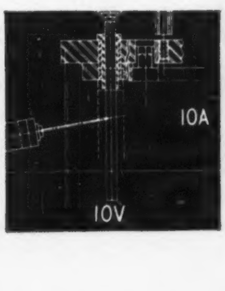
Unit 6V .422 undersize drills down thru two walls. Unit 6U .625 drills up thru ninth wall. Unit 7V .421 drills down thru three more walls. Unit 8V .4531 end-reams the hole thru five walls. Unit 9V .453 drills the hole thru. Units 10V and 11V .4687 rough end-ream and .4882 semi-finish ream the hole.

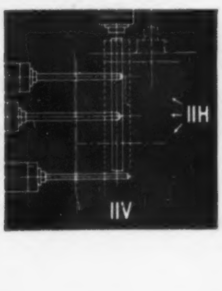
Section FF: Unit at 11H drills .343 dia. and .281 dia. partial holes shown; and four .281 dia. holes not shown.

Section BB: Unit 5H Right .312 drill thru both walls.

Section CC: Unit 5A Right .218 drills hole C1 full depth. Four Units operate on step-hole at C2; Unit 5A Left .060/.065 drills thru; Unit 7A Left .156 drills 17/32 deep; Unit 8A Left .094 drill undersize, and Unit 9A Left .094/.096 reams the hole.







Each Unit Cost on the drawings
includes the cost of the man and of the machine — no power or overhead. We assumed:

Unit cost of man equal to:

$$\frac{\text{average U. S. hourly wage}}{\text{hourly gross} \times 80\%\ \text{efficiency}}$$

Unit cost of machine to be:

$$\frac{\text{price of tooled machine}}{\text{output in 6000 hrs. @ 80\% efficiency}}$$

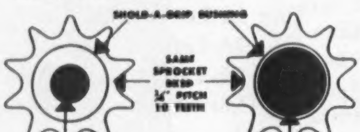
New Buy-word for Top Value

SHOLD

Typical design (above) of SHOLD-A-GRIP Bushing and Sprocket with minimum number of teeth.
Typical design (below) of SHOLD-A-GRIP Bushing and Sprocket with maximum number of teeth.

FIT SHAFTS
½" to 2½" by 16ths

SHOLD-A-GRIP Sprockets of any commonly used pitch, ½" to 1¼", can be interchanged on an extended range of shaft sizes. SHOLD-A-GRIP design adds many smaller sprocket sizes to the interchangeable class.



Example: Sprocket BKSD, ¾" pitch, 10 teeth, can be used on 9 different shaft sizes, any size from ½" to 1" by 16ths, by inserting the correct size SHOLD-A-GRIP Bushing.

Engineered *originally* and *specifically* for Sprocket drives, SHOLD-A-GRIP Bushings are *not* an "adapted" design. Compare . . . see why SHOLD-A-GRIP means top efficiency, lowest maintenance costs.

GEARS • CHAIN and SPROCKETS • RATIOMOTORS • REDUCTORS • BOST-BRONZ Oil-Impregnated BEARINGS • PILLOW BLOCKS •

in Sprocket Assemblies . . . ask for

-A-GRIP®

Interchangeable Tapered BUSHINGS and SPROCKETS

You'll be Sure to get...

Correct Taper FOR SLIP-PROOF GRIP

In SHOLD-A-GRIP Bushings and Sprockets, you get a taper proved by exhaustive overload tests to be the optimum for slip-proof grip. When screws are tightened the bushing grips both sprocket and shaft with maximum holding power, even on shafts which vary from true diameter.

Correct Taper FOR EASY REMOVAL

Correct taper saves time and trouble in removal. Cap screws are removed, then two screws are turned into the two threaded holes in bushing flange. Tightening screws releases bushing—quickly, easily.

Matched Tapers AVOID "ROCKING" FIT

All Bushing and Sprocket tapers are machined with integrated and matched tooling, to avoid possible variation from random production. There is no risk of a "rocking" fit. SHOLD-A-GRIP gives you fast, free interchangeability, over the entire size range.

High-strength Design BY BOSTON Gear EXPERTS

Because of the unique, patented SHOLD-A-GRIP construction, holes for screws are in the shoulder. There are no weakening holes in the sprocket itself. BOSTON Gear quality throughout assures longer service life on your toughest drives.

**Completely engineered and manufactured by BOSTON Gear . . .
for 75 years the leading specialists in Stock Gear and Sprocket design.**

Complete information on SHOLD-A-GRIP Bushings and Sprockets is available from your Boston *Gear* Distributor, or write Boston Gear Works, 65 Hayward St., Quincy 71, Mass.

ASK YOUR NEARBY BOSTON Gear® DISTRIBUTOR

UNIVERSAL JOINTS • COUPLINGS • BALL BEARINGS • OVER 5000 STOCK ITEMS

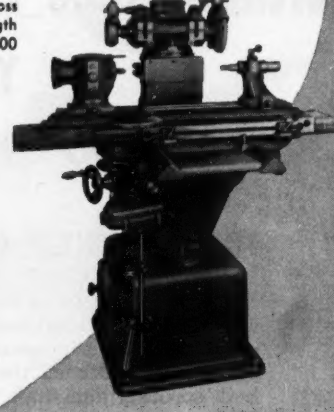
QUALITY MACHINE TOOLS PRICED TO MEET YOUR BUDGET!

For your complete program in the tool room or the production line these fine European machine tools offer efficiency, precision and *economy!* Constructed of the finest materials and built to meet American standards and specifications they offer excellence at prices that are hard to duplicate.

H & K ENGRAVING MACHINE GM2A

2 dim. working table; 17" x 12"; Panto. movement; Long. 12", trans. 8"; Spindle speeds (6) 2800-15,000 RPM; Motor drive.

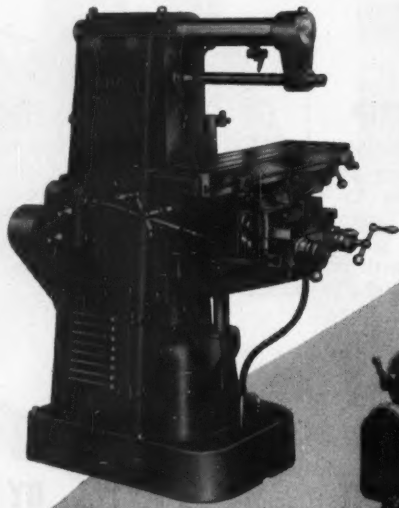
Price.........$2511.00



H & K WSR 0 UNIVERSAL TOOL & CUTTER GRINDER

Table movement, Long. 16", cross 10"; Cylindrical grinding length 8-4/5"; Spindle speeds 3000-6000 RPM; Motor 1 HP.

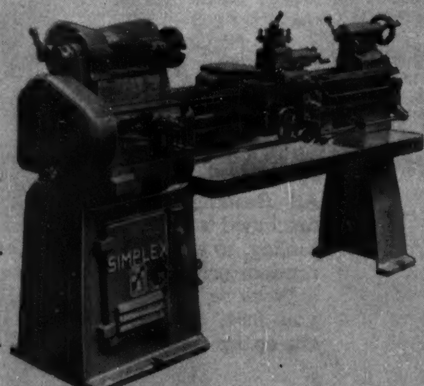
Price.........$2841.00



HERO MILLING MACHINE UNIVERSAL 4U (Illustrated) PLAIN 4P

Size of table 30" x 9¼" with 3 T-slots; Long. power travel 18"; Spindle speeds (12) 53-1250 RPM; Motor 2½ HP; Anti-friction bearings; Large table 40" x 9¼" as extra; Accessories available.

Price 4U.........$2795.00
Price 4P.........$2660.00

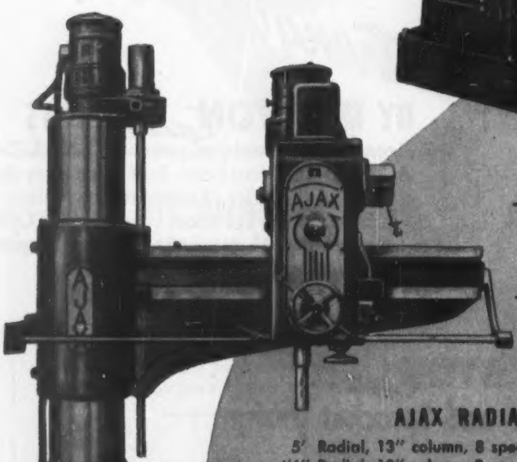


STOCK DELIVERY

13¾" SIMPLEX LATHE
30"-40"-60" C.C.

Engine gap lathes. Quick change gear. Spindle speeds (12) 47-900 RPM; Motor drive.

Price 30".........$1995.00
Price 40".........$2065.00
Price 60".........$2195.00



AJAX RADIAL DRILL

5' Radial, 13" column, 8 speeds 60-1114 RPM; #4 M.T.
4'6" Radial, 13" column, 8 speeds 60-1114 RPM; #4 M.T.
4' Radial, 13" column, 8 speeds 60-1114 RPM; #4 M.T.

Price.........$5765.00

All prices include standard equipment with motors. For complete information and specifications on any of these machines write, phone or wire . . . Better still, visit our demonstration hall!

ALL PRICES F.O.B. NEW YORK CITY
SALES TERRITORIES OPEN
Prices subject to change without notice.

MOREY ...*for machine tools!*

MOREY MACHINERY CO,. INC.
Manufacturers • Merchants • Distributors
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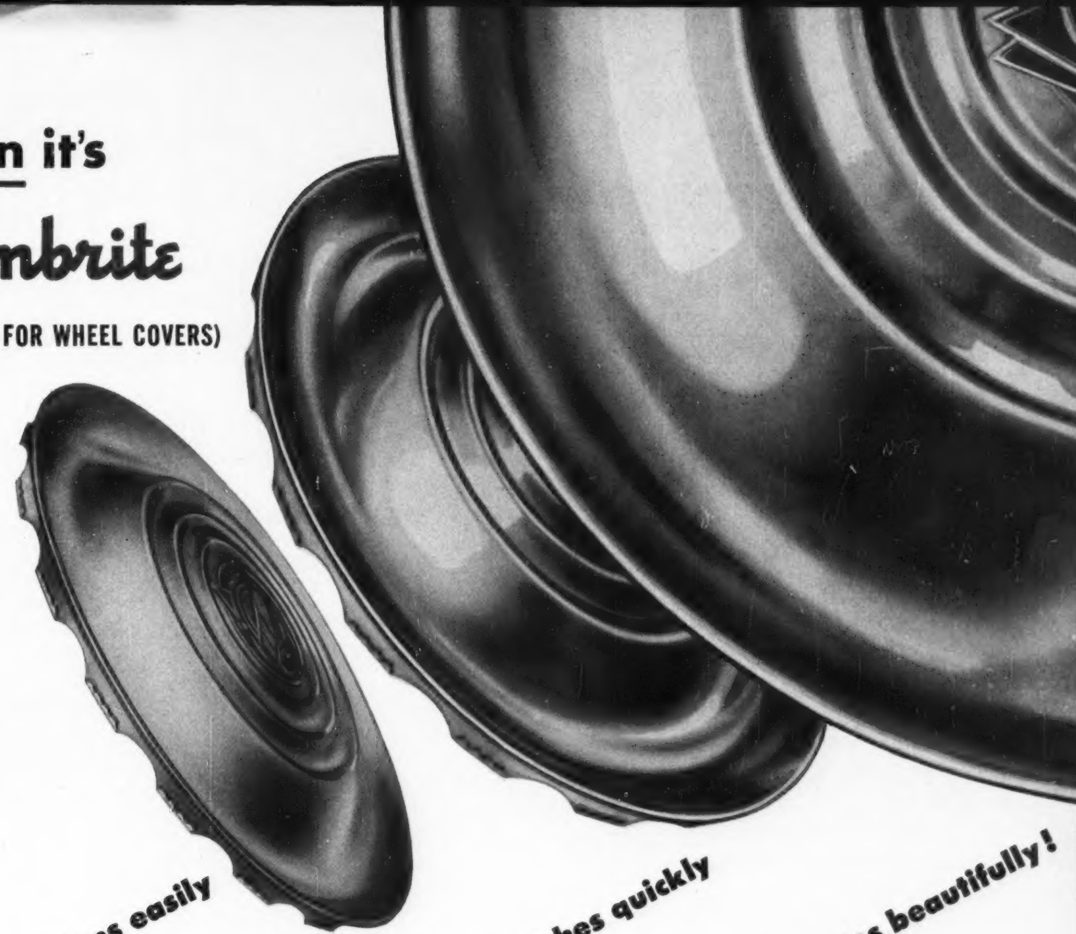
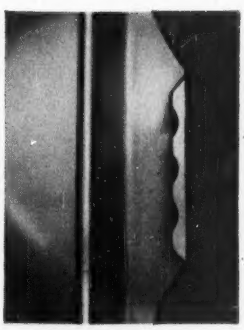
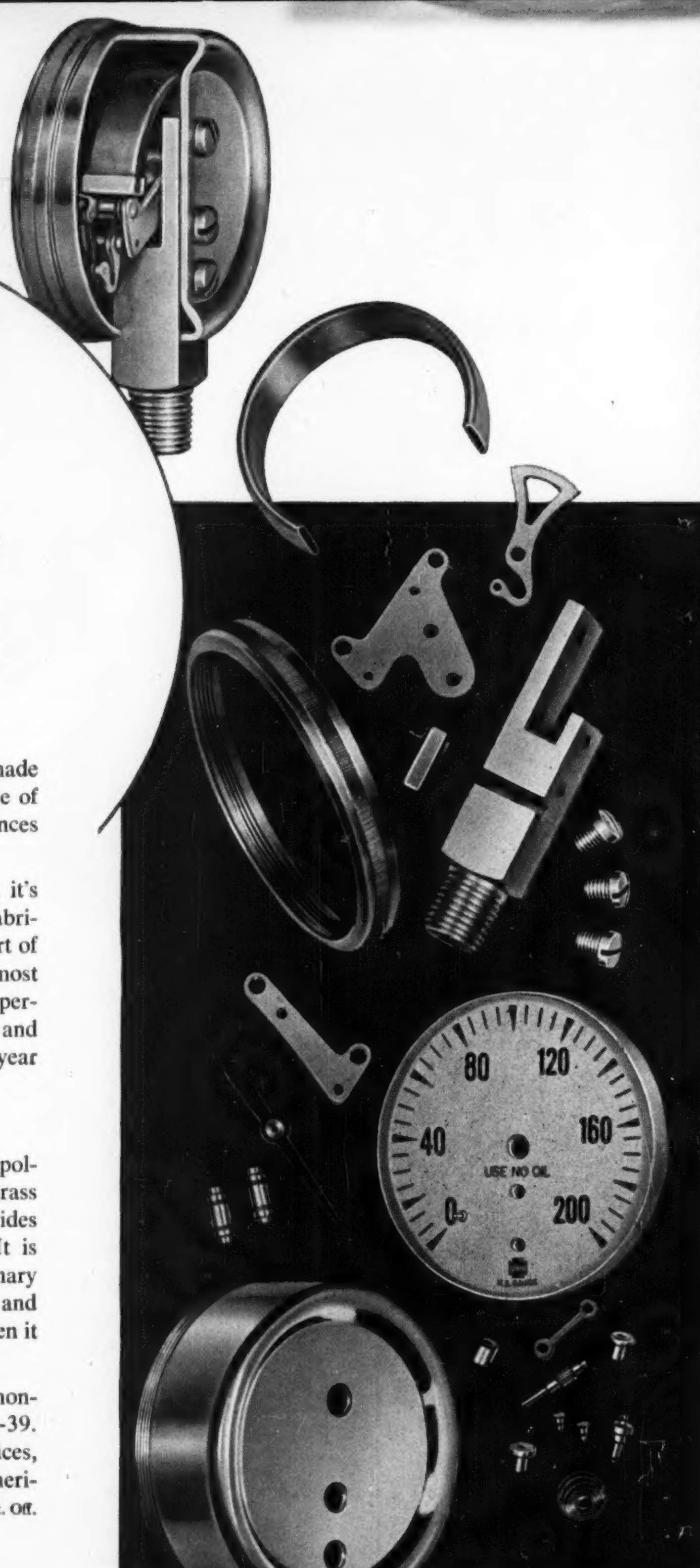




PRESSURE

It's big business at U.S. Gauge where **brass** **belongs**



Gauge and components courtesy of
UNITED STATES GAUGE
DIVISION OF AMERICAN MACHINE AND METALS, INC.
Sellersville, Pa.

For the ultimate in precision, eleven different Anaconda Alloys in the form of rod, tube, sheet and strip are used in producing the components of the U. S. Gauge illustrated above.

At Sellersville, Pa., millions of pressure gauges are made each year—for every type of industry—to every degree of accuracy—and for pressures ranging from a few ounces per square inch up to 100,000 pounds.

With each gauge a precision instrument unto itself, it's quite a job to maintain the high standards of routine fabricating procedure on each of its many components. Part of it depends on having just the right copper alloy in the most satisfactory combination of chemical and physical properties. That's where teamwork between U. S. Gauge and Anaconda Metals has been clicking day after day, year after year.

and now—something NEW has been added . . .

U. S. Gauge is now using Formbrite* for many of its "polished and lacquered" and chromium plated solid brass gauge cases. Formbrite, with its superfine grain, provides a surface far superior to ordinary drawing brass. It is stronger, harder, more scratch-resistant than ordinary brass, yet retains remarkable ductility for forming and drawing. Best of all, Formbrite is a real time saver when it comes to finishing operations.

Want to know more about this "premium product at a non-premium price"? Write for Anaconda Publication B-39. Address: The American Brass Company, General Offices, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario. *Reg. U. S. Pat. Off.

Formbrite DRAWING BRASS

An ANACONDA Product

Made by The American Brass Company

If you're in the market for special machines or special tooling...

▶ Kearney & Trecker Special Machinery Division—an old hand in the business—has a brand new plant and greatly expanded facilities to build the big or small special equipment you need

THOUGH we've designed and built up to $3,000,000 worth of special machinery annually . . . have been in the field since 1898 . . . we've never publicized the fact till recently. Limited production facilities prevented taking additional orders.

But now we have a new plant built exclusively to produce special machines, special tooling and special adaptations of standard equipment. This plant, with approximately 200,000 sq. ft. of floor space, is equipped with more than $2,500,000 worth of the very latest tools and equipment. It's at your service.

We've worked with the best of them

In practically every industry . . . automotive, shoe machinery, aviation, etc. . . . there have been many installations of Kearney & Trecker special machines. These machines were custom-built to solve unusual metalworking problems. They provide extremely high production even with exacting dimensional accuracy and fine surface finish requirements.

We're staffed with engineers who have learned the business from the ground up

Our Special Machinery Division engineering section has almost 100 widely-experienced design, project and production engineers. These men are up-to-the-minute on the latest developments in applied mechanics, hydraulics, electronics, metallurgy and allied fields. They know exactly how to utilize these advances in the design and construction of outstanding special machine tools. In addition, it has a full complement of experienced machinists and mechanics needed for special machine construction.

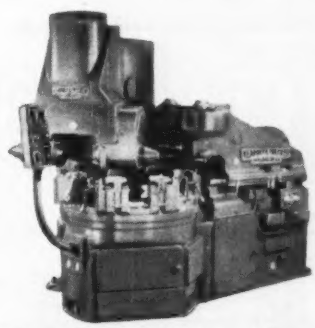
Every special machine is backed by the entire Kearney & Trecker organization

The Special Machinery Division is an integral part of Kearney & Trecker, a corporation that does an annual business in excess of $25,000,000. Every product, every commitment we make, is fully backed by our reputation for quality, cooperation and ability to live up to promises. Every machine is designed, then built, to your specific requirements with ample reserve for emergencies.

We invite your inquiry

We'll be glad to provide you with any information we can . . . including sample machine specification sheets on typical installations, a brochure covering the expanded facilities of our Special Machinery Division, and details on our Customer Engineering Service. Furthermore, if you have special production machinery problems, have one of our senior Project Engineers analyze them, without obligation, of course.

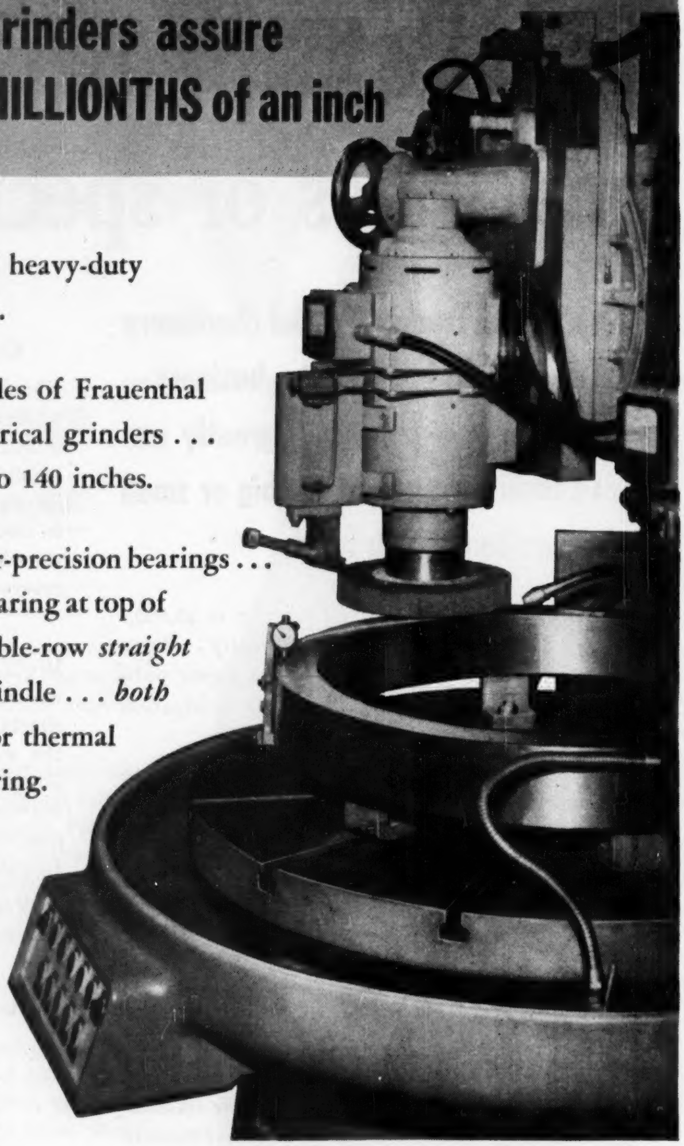
Write, wire or phone the Special Machinery Division, Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wisconsin.



We've built special machines or adaptations of standard equipment for practically every industry. Here is a photo of a three-station rotary indexing machine we designed and built for a major automotive manufacturer.

KEARNEY & TRECKER
MILWAUKEE
MACHINE TOOLS ®

WHY Frauenthal Grinders assure precision to MILLIONTHS of an inch



HOW? By use of KAYDON heavy-duty super-precision, pre-loaded bearings.

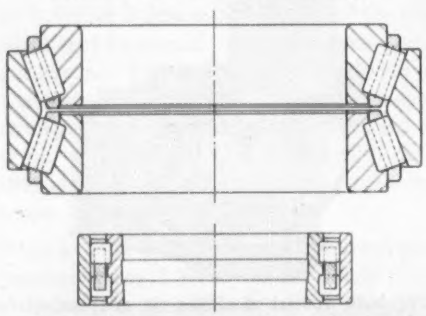
WHERE? In the table-spindles of Frauenthal Double-Head super-precision cylindrical grinders . . . table-sizes ranging from 30 inches to 140 inches.

WHAT? Two oversize, super-precision bearings . . . one is a double-row *tapered* roller bearing at top of table-spindle . . . the other is a double-row *straight* roller bearing at bottom of table-spindle . . . *both preloaded* and designed to allow for thermal changes without affecting upper bearing.

Precision-Proven for over a decade

For over 10 years Frauenthal Grinders have been performance-proved on precision grinding of parts for aircraft, jet and automotive engines, tanks, gun mounts, radar units, Diesel parts, valves, large precision bearings and other precision parts and assemblies.

Cross section of both bearings



Let's discuss *your* grinding problems

With these modern grinders, you can make many combinations of grinding-spindle positions for a wide variety of simultaneous grindings of outside and inside diameters or faces, to extremely close tolerance of .000200" (200-millionths of an inch) *or better*. Valuable grinding, boring, turning details on request.

In 10 standard sizes, conforming to J.I.C. specifications

	Series 1800				Series 2000		Series 2200			
Table sizes	30"	36"	42"	48"	60"	72"	110"	120"	130"	140"
Maximum swing	60"	60"	60"	60"	72"	88"	120"	130"	140"	150"

Frauenthal

MULTIPLE-HEAD SUPER-PRECISION CYLINDRICAL **Grinders**

PRECISION-GRIND INSIDE, OUTSIDE AND FACES SIMULTANEOUSLY TO MILLIONTHS OF AN INCH!

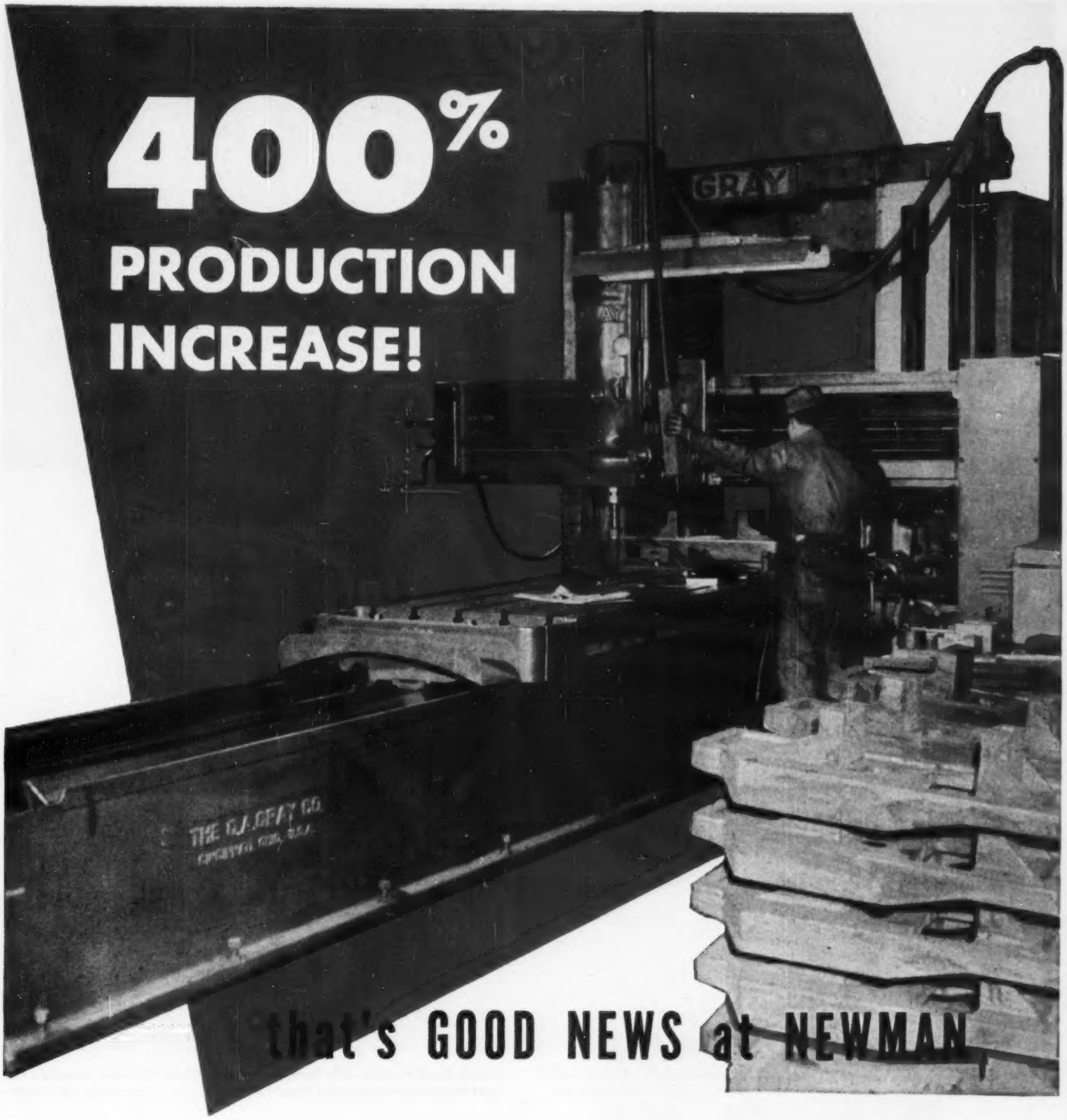
write for bulletin

Frauenthal Division

THE KAYDON ENGINEERING CORP.

MUSKEGON, MICHIGAN

400% PRODUCTION INCREASE!



that's GOOD NEWS at NEWMAN

GRAY is paying off at Newman Machine Co., Inc., Greensboro, N. C.
A new GRAY 48" x 48" x 16' Milling Machine is on the job. GRAY's unit head versatility, great operating convenience, and high precision performance slashed milling time to 1/4 . . . increased production 400%.
Further proof that a GRAY in your shop will look just as good to your Treasurer as to your Superintendent.

Write today • get the story on
HIGH low cost
PRODUCTION

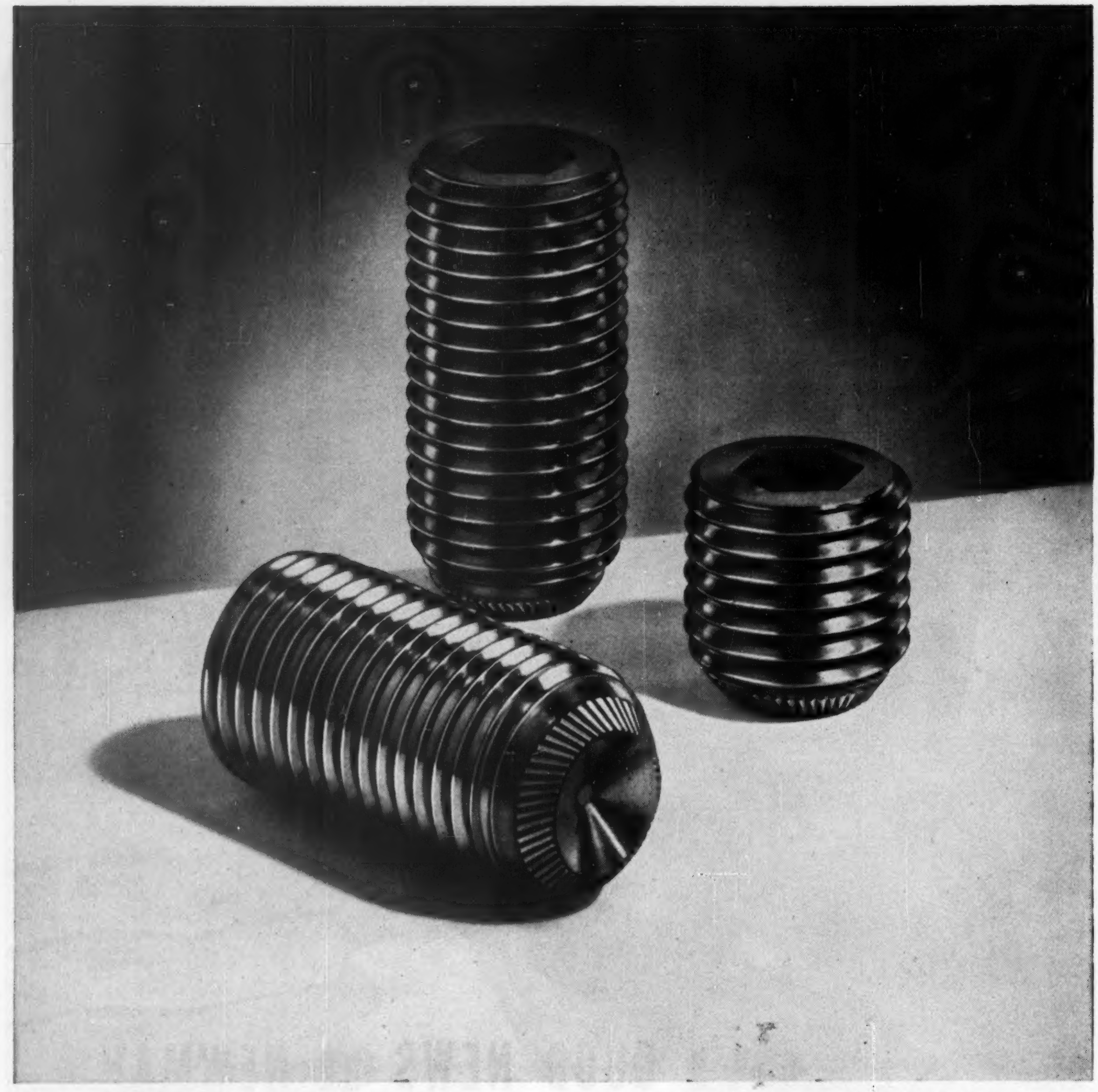
DEPT. B

The G.A. GRAY Company

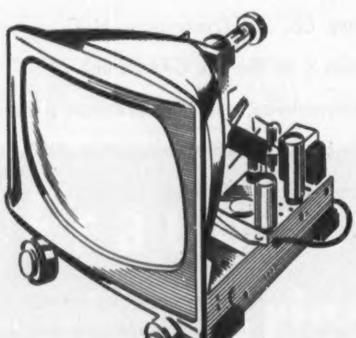
planers • milling planers
planer type milling machines
horizontal boring machines

CINCINNATI 7, OHIO, U. S. A.

SOLD IN CANADA BY UPTON, BRADEEN AND JAMES, LTD. • SOLD IN LATIN AMERICA BY MACHINE AFFILIATES



UNBRAKO SELF-LOCKING SOCKET SET SCREWS feature the following advantages: knurled cup point that won't work loose; accurate hex socket for nonslip, positive drive; fully formed threads—Class 3 fit; heat treated alloy steel for strength; standard sizes—# 4 to 1''—in a full range of lengths.



USE UNBRAKO SELF-LOCKING SOCKET SET SCREWS wherever ordinary cup point set screws are used ... on radios, television sets and electronic equipment.

On refrigerators, washers, other household appliances

9 times out of 10 a standard UNBRAKO will do the job

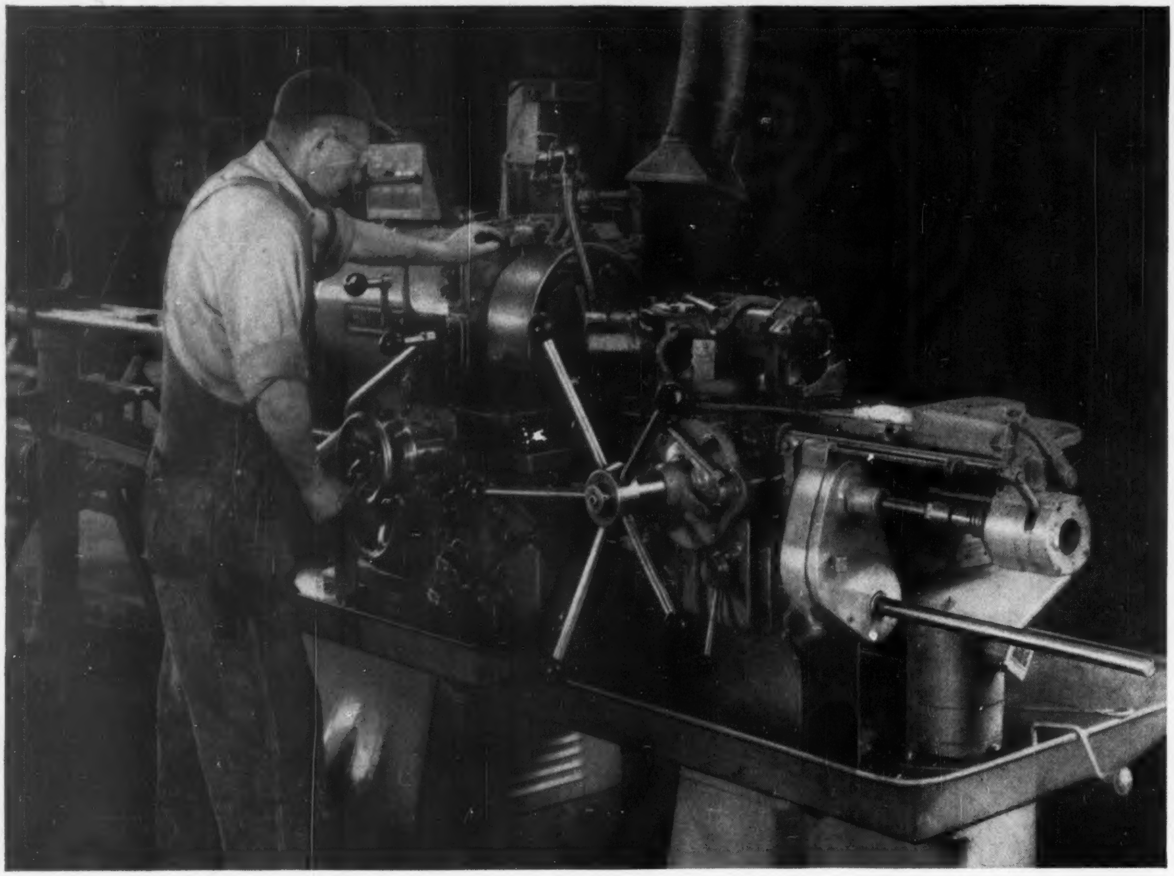
A special socket screw may not be necessary, a standard UNBRAKO usually does the same job—much cheaper. Your local industrial distributor stocks Standards. He gives immediate attention to your requirements, and such extras as special delivery to your plant. Write for a copy of UNBRAKO Standards. SPS, Jenkintown 19, Pa.

UNBRAKO® SOCKET SCREW DIVISION

SPS
JENKINTOWN PENNSYLVANIA

On power mowers, power saws and other power tools.

UNBRAKO Standards—as listed in the SPS Catalog—are stocked by leading industrial distributors everywhere.



MACHINING FOR GOLD at Homestake

with Gisholt Turret Lathes

Yes, gold mining means machinery. And here at the famous Homestake Mine at Lead, South Dakota, Gisholt Turret Lathes help to machine the machines that dig for gold. It's a big job, too—turning out the variety of rock bits and drill rods that are used up in large numbers.

This Gisholt Ram Type Lathe was first used to turn the plain ends on the one-inch quarter-octagon drill steel for two types of rock bits. Production averaged 30 an hour. Now, the machine is also used to machine and thread three sizes of forged steel drill rods. Besides all this, the Gisholt has the job of facing and chamfering the chuck, or shank ends, of the drill steel so that a perfectly flat face is hit by the drill machine tappet.

Here, again, Gisholt Ram Type Turret Lathes prove their easy change-over and ability to produce profitably, even on small runs—big assets in any machine shop. Ask your nearest Gisholt representative about them. Or write us.

GISHOLT MACHINE COMPANY

Madison 10, Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES

Tool Steel Topics

Three types of tool steel solve most hot-work problems

Hot-work tool steels which contain large amounts of either tungsten or molybdenum have high "red-hardness." In other words, they withstand very high operating temperatures without softening.

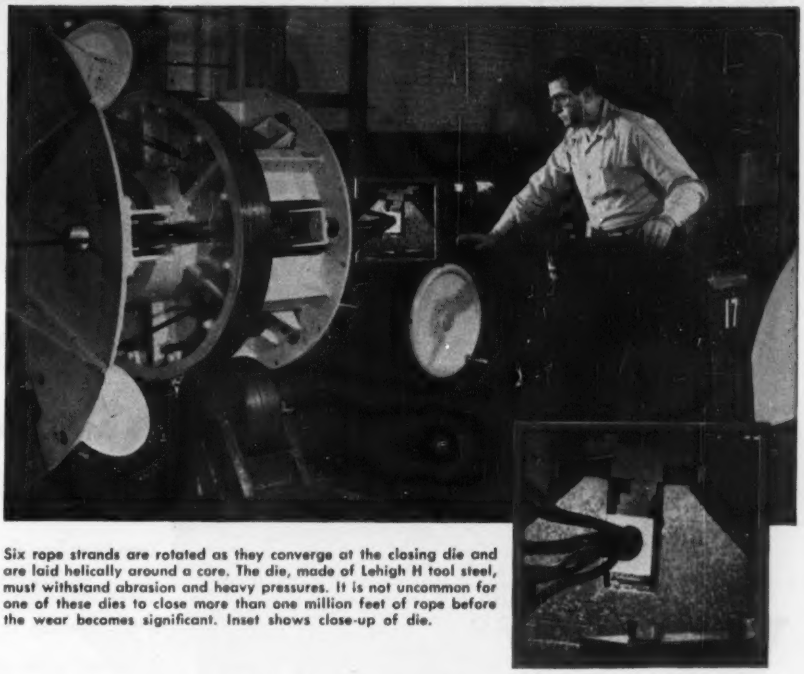
Although these steels have excellent wear-resistance, they cannot be subjected to drastic water-cooling while in operation because this results in excessive "heat-checking." Caused by repeated thermal stress, this condition shortens their service life. The 8½-pct-molybdenum type (our Hot-Work 8) is better in this respect than the 9-pct-tungsten type (our 57 Hot-Work).

One way to prevent excessive temperature build-up, in repetitive operations where water-cooling is not used, is to provide duplicate tools which can be used alternately in the operation. This arrangement makes possible a longer cooling time between operations than if only one tool is used.

Whenever the nature of the hot-work operation is such that water-cooling of the tool is practical, it is often best to use one of the 5-pct-chromium types of hot-work steel—such as our chrome-moly-tungsten (Cr-Mo-W) and chrome-moly-vanadium (Cr-Mo-V) grades. The cooling prevents loss of hardness due to high temperature.

Although they have lower red-hardness, the 5-pct-chromium grades are good choices for tools and dies which involve both shock and hot-metal contact.

Operated in a 400-ton press, this punch is made of Bethlehem Cr-Mo-W tool steel. It extrudes steel slugs heated to 1950 F in the making of rock bits.



Six rope strands are rotated as they converge at the closing die and are laid helically around a core. The die, made of Lehigh H tool steel, must withstand abrasion and heavy pressures. It is not uncommon for one of these dies to close more than one million feet of rope before the wear becomes significant. Inset shows close-up of die.

Wire rope "closed" by long-wearing dies of LEHIGH H tool steel

One of the vital steps in the making of wire rope is the "closing" operation which arranges the rope strands compactly in a helical position around a core of either hemp or steel wire.

Closing dies are subject to considerable abrasion by the rotating strands as they converge at the die and pass through, at the same time being laid into accurate position. Lehigh H is ideal for this application because its high-carbon, high-chromium composition gives it extreme long-wearing properties. When the dies eventually become worn, they are usually refinished for use in closing rope of a larger diameter.

Made in two pieces, closing dies are machined to accurate size, heat-treated to a hardness of about Rockwell C-61; then they are ground and polished to avoid damage to the wearing surfaces.

Because of its air-hardening characteristics, Lehigh H is subject to only the minimum amount of distortion during heat-treatment—an important feature wherever accuracy is essential.

BETHLEHEM TOOL STEEL ENGINEER SAYS:

Avoid sharp-cornered keyways

Keyways with sharp corners are the cause of many shaft failures. Fundamentally, this type of breakage is a fatigue-failure due to excessive stress-concentration at the sharp corners.

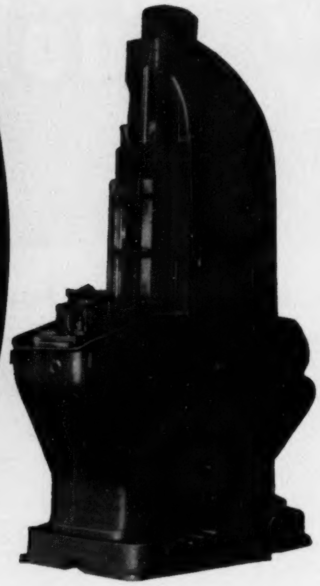
The cure for failures of this kind is to make keyways of half-round design and use a round key in the assembly.

Of course, the fact that stresses are low often prevents the failure of shafts with square keyways; and so this design continues to be used. But that does not alter the fact that a square keyway on a shaft is a basic design fault.

Duplex Surface Broaching Machine.
Made in 5, 10, 15 and 25 Ton Sizes.

for increased production

latest surface broaching methods on cast iron parts, teeth serrations and slots..



Single Slide Surface Broaching Machine. Made in 5, 10, 15 and 25 Ton Sizes.

Continuous Type Broaching Machine.
Made in 4 Sizes.

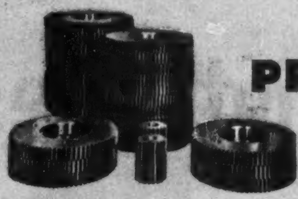
● Whether the material is steel or cast iron, parts are being successfully surface broached on Footburt machines. Broaches used on Footburt Surface Broaching Machines have a patented tooth that is especially advantageous on heavy cuts. We will be glad to work with you on your machining problems and make recommendations based on our many years experience in surface broaching.

THE FOOTE-BURT COMPANY, Cleveland 8, Ohio

Detroit Office: General Motors Building

FOOTBURT

SURFACE BROACHING



Cylinder gears—ground on a Reishauer ZA.

PRECISION GEARS...

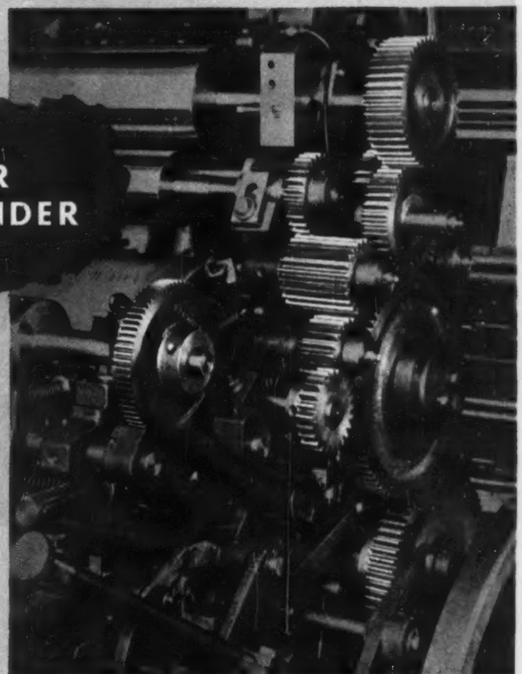
the heart of fine printing presses...

are ground by AMERICAN TYPE FOUNDERS

on a

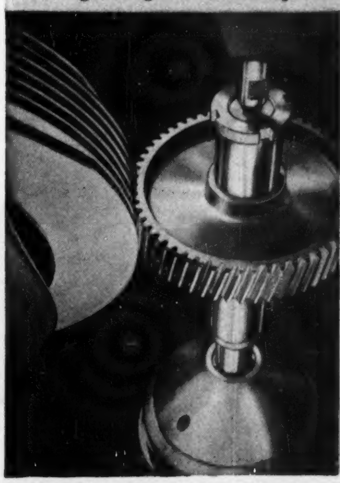
REISHAUER ZA GEAR GRINDER

Precision gears in a printing press are important, but cylinder gears on the ATF Chief are vital—they, in particular, must be accurately ground to prevent gear streaks on printed material, and they must be durable, to provide long-term accuracy. Therefore, ATF makes these gears from hardened alloy steel and precision-grinds them on the Reishauer ZA.



Gear train on an ATF Press—ground on a Reishauer ZA.

Heart of the Reishauer ZA—grinding wheel and spindle.



ATF is not alone in its respect for Reishauer's speed and accuracy—this machine is widely used to grind spur and helical gears in the automotive, aircraft, machine tool, gear-jobbing, and instrument industries.

Why is the Reishauer ZA so widely used? For one thing, it combines accurate grinding with production speed. For instance, floor-to-floor grinding time, on pre-hobbed gears, is about 8 to 13 seconds per inch-tooth.

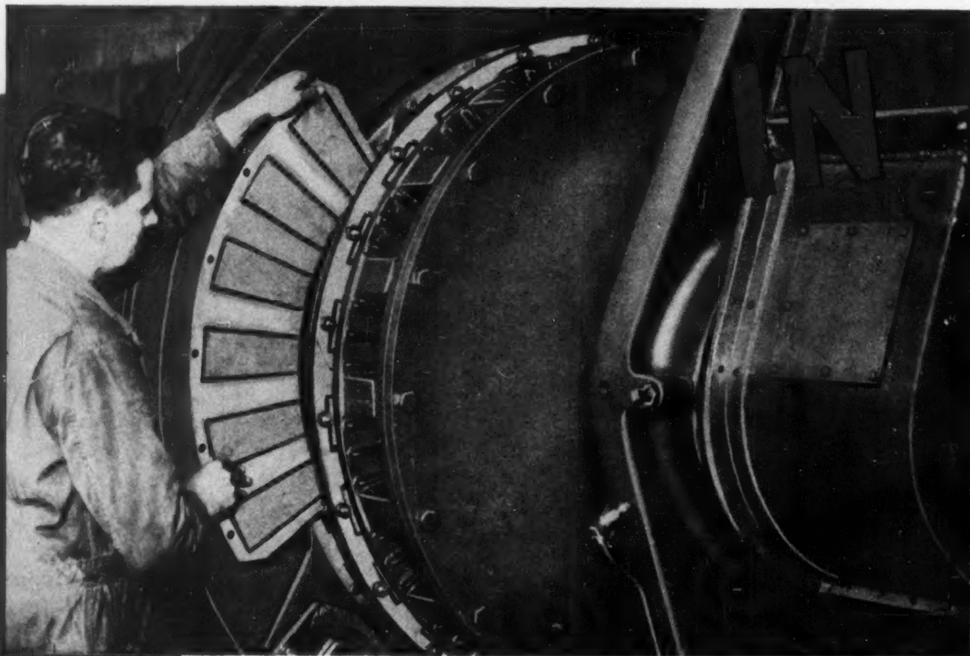
There are many other reasons why the Reishauer ZA is the best production gear grinding machine you can get. If you want proof, we'll be happy to supply it. Get in touch with us soon, won't you?

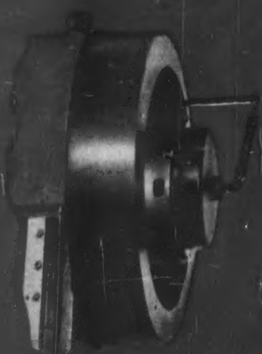
COSA CORPORATION
405 Lexington Ave., New York 17

Your source for all Precision Machine Tools—from Small Bench Lathes to Large Boring Mills

'N DETROIT AREA contact DETROIT-COSA CORPORATION, 16923 James Couzens Highway, Detroit 35, Mich.

BLISS has the "right" design



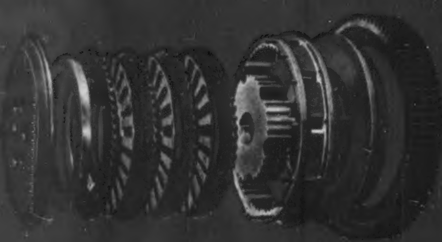


Type "D" Friction Clutch

FOR INSTALLATION ON PRESS CRANK-SHAFT. Provides fast action when working hot metal — helps avoid annealing. Operates perfectly under difficult conditions.

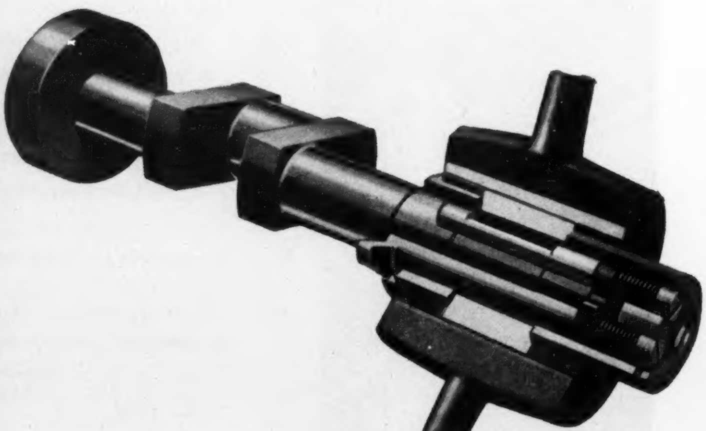
Type "K" Friction Clutch

FOR MEDIUM SIZE AND LARGER PRESSES. Highly compact brake and clutch unit. Cool-running, dependable and self-aligning. Friction plates are removable without disassembling clutch.



Type "F" Friction Clutch

FOR FORGING PRESSES AND HEAVY DUTY MACHINERY. A high torque multiplier unit that provides the extreme in clutch capacity. It requires no adjustments.



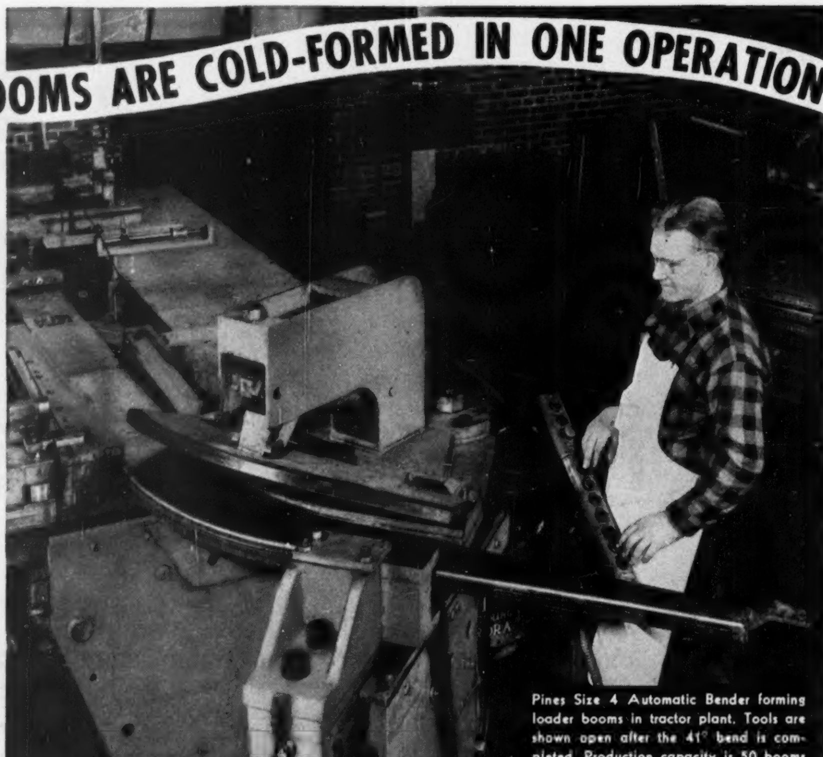
Rolling Key Clutch

FOR PRESSES UP TO 100 TONS CAPACITY. The all-purpose positive clutch, considered by thousands of users to be the finest positive clutch available. Equipped with "oilless" bearings.

HOW HOLLOW BOOMS ARE COLD-FORMED IN ONE OPERATION

on a

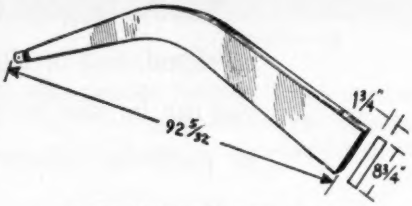
PINES
Automatic
BENDER



Pines Size 4 Automatic Bender forming loader booms in tractor plant. Tools are shown open after the 41° bend is completed. Production capacity is 50 booms per hour, one operator.

41° Edge Bend in Heavy 12-Gauge Stock Simplifies Production Problem

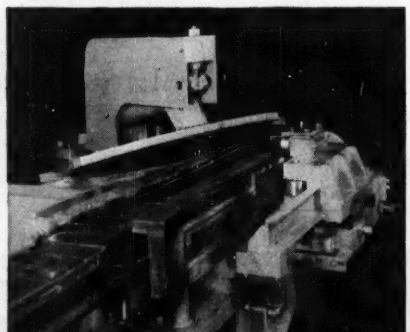
Here's another example of how cold-forming the "Pines-Way" speeds production and lowers costs. The setup illustrated shows tooling on a Size 4 Bender used for edge bending a heavy 12-gauge (.112") hollow tractor loader boom. The pieces are fabricated with a gradual taper, and two straight U-shaped strips are arc-welded together. By adopting the Pines bending method, instead of making curved pieces on a press, a substantial reduction in die cost and scrap losses are affected.



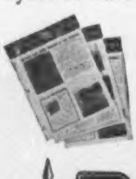
LOADER BOOM FOR FARM TRACTOR
Workpiece is fabricated from two tapered U-shaped pieces, arc-welded together. Both right-hand and left-hand booms are formed on same machine.

Smooth, Accurate Bends Produced in Tapered Section

The Bender and special tooling, engineered by Pines, produces a smooth 41° edge bend to a 34" radius. The draw bending principle employed permits holding close tolerances for easy assembly. By using a flexible floating-type mandrel, tapered to fit the inside of the workpiece, and a separate hydraulically-operated hold-down shoe that works in sequence with the clamping die, wrinkles and buckles are eliminated. One man handles the entire bending operation. The hydraulic bending and return cycle is automatic, push-button controlled.



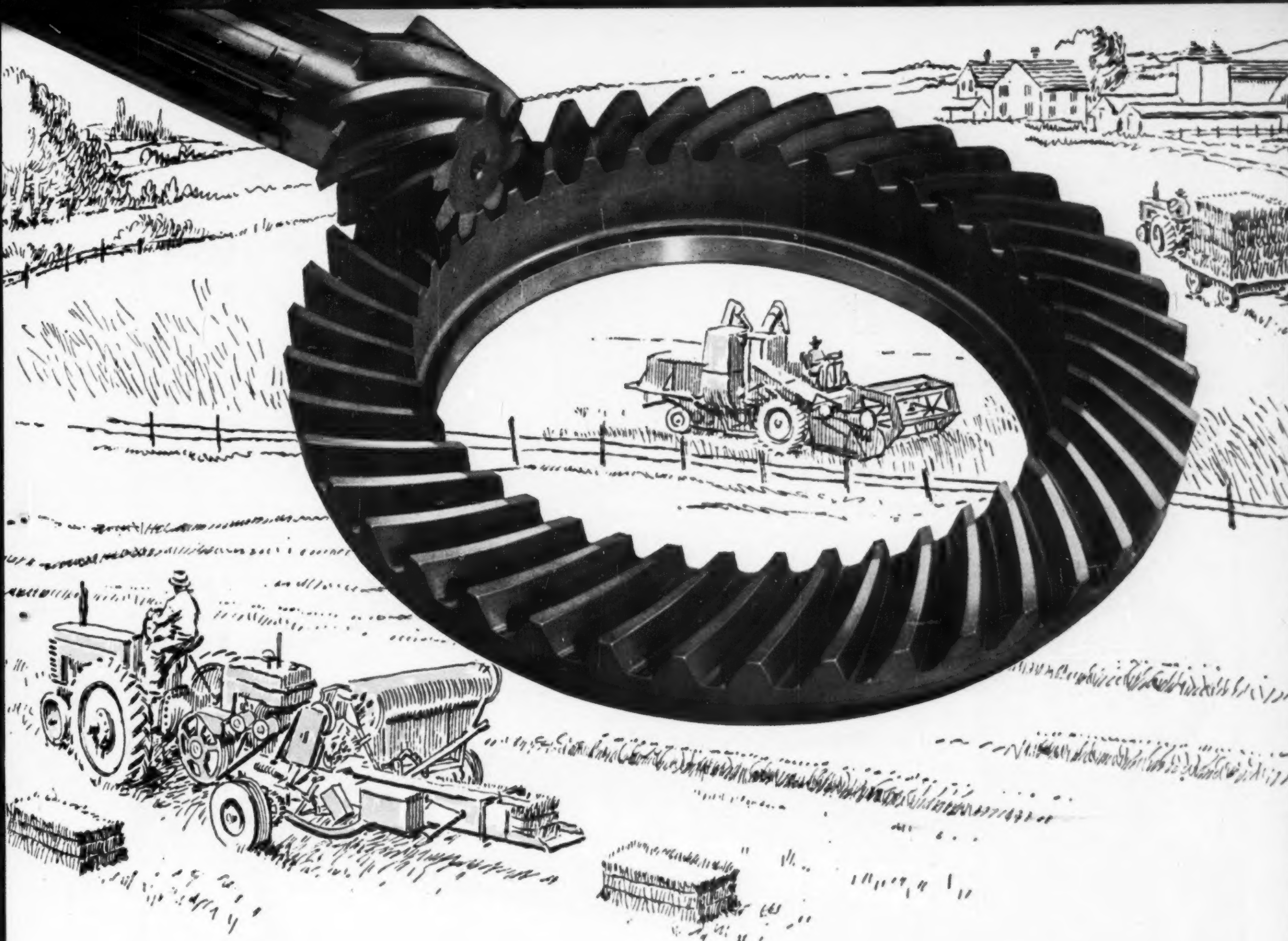
View of floating-type flexible mandrel and tapered sliding pressure die. Automatic air-operated support holds mandrel in proper alignment on forward stroke, retracts for clamping. Same machine with different tooling also cold bends 3" heavy wall pipe for undercarriage loader supports.



WRITE FOR *Free* DATA SHEETS
To get a better idea of the cost-cutting advantages and unusual versatility of Pines Benders, write today for free copies of "Pines News" illustrating and describing actual bending and tooling techniques on a wide range of jobs.

PINES ENGINEERING CO., INC.
Specialists in Tube Fabricating Machinery
BENDING · DEBURRING · CHAMFERING · THREADING · CUT-OFF MACHINERY

687 WALNUT • AURORA, ILLINOIS



AGRICULTURE – geared to modern production standards

A self-propelled combine, handled by one man, will work rings around the old-fashioned threshing crews of a few years ago. And a modern hay-baler does in a few hours, at a single operation, the tedious work that required days of work not long ago. That's modern production—just as efficient—just as important to the nation's good—as the miracles of America's great industries.

We're particularly aware of this development because "Double Diamond" Gears have grown up with the flourishing farm machinery business. For years "Double Diamonds" have been transmitting power in all kinds of mechanized farm equipment. As the machines grew bigger—as demands of them became more critical—"Double Diamond" Gears have grown in demand. They must stand unusual abuse—long periods of idleness followed by around-the-clock service months on end—and must deliver dependable performance at points many miles from service centers. The fact that "Double Diamonds" have met these requirements, and for so many years, makes them a name to bear in mind when your needs call for gears of that character.

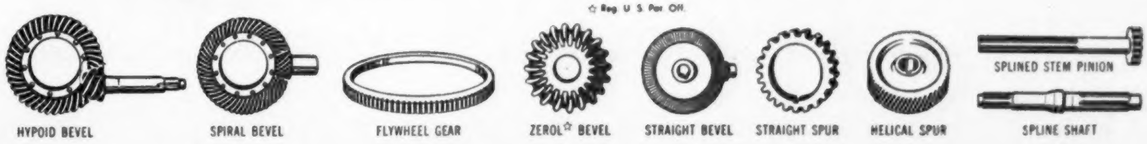
DOUBLE DIAMOND TRADE MARK GEARS

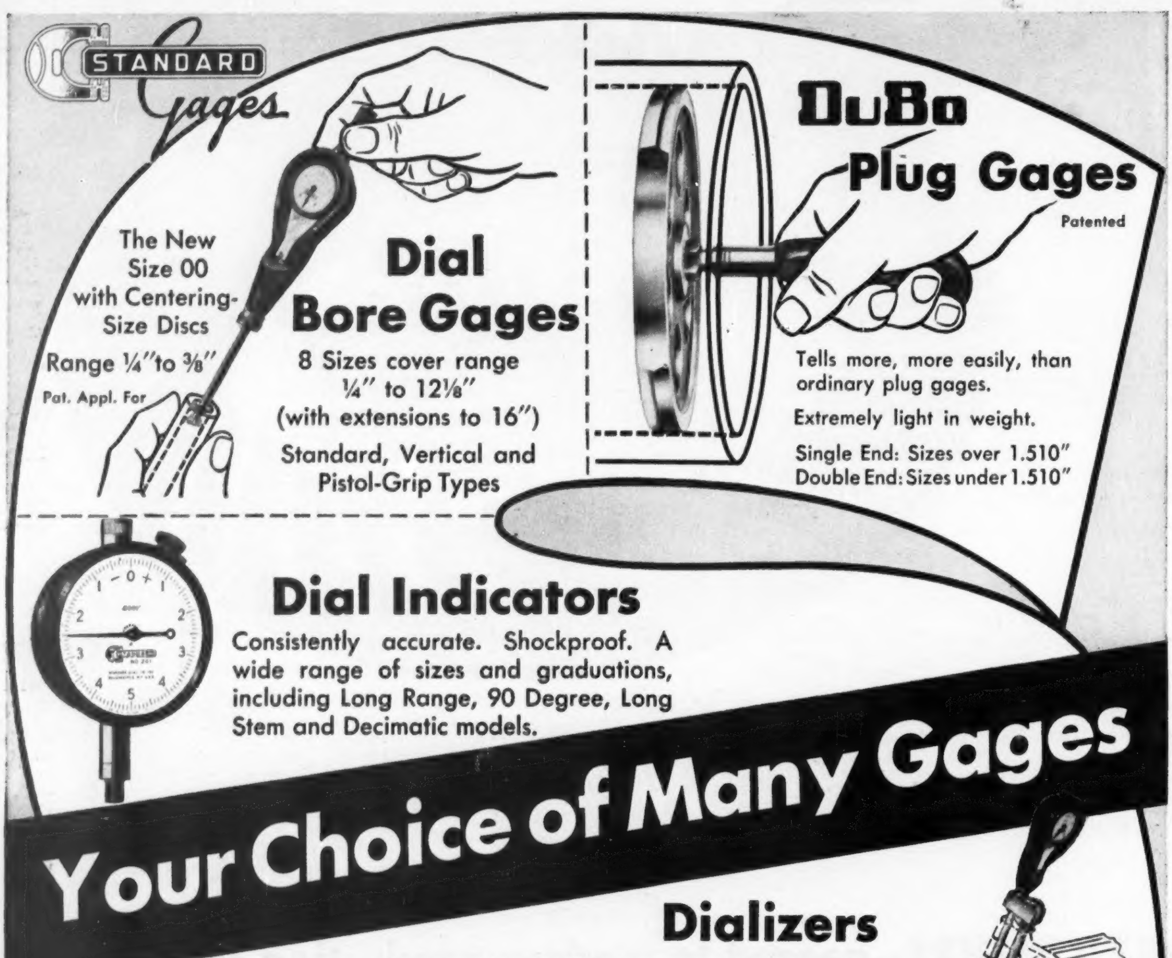
AUTOMOTIVE GEAR WORKS

RICHMOND, INDIANA

FOR AUTOMOTIVE, FARM EQUIPMENT AND GENERAL INDUSTRIAL APPLICATIONS

☆ Reg. U. S. Pat. Off.




STANDARD Gages
The New Size 00 with Centering-Size Discs
Range ¼" to ⅜"
Pat. Appl. For
Dial Bore Gages
8 Sizes cover range ¼" to 12⅛" (with extensions to 16")
Standard, Vertical and Pistol-Grip Types
DuBo Plug Gages
Patented
Tells more, more easily, than ordinary plug gages.
Extremely light in weight.
Single End: Sizes over 1.510"
Double End: Sizes under 1.510"
Dial Indicators
Consistently accurate. Shockproof. A wide range of sizes and graduations, including Long Range, 90 Degree, Long Stem and Decimatic models.
Your Choice of Many Gages
Dializers
An economical, effective means for converting AGD Adjustable Limit Snap Gages (Models A, B or C) to Dial Snap Gages. Easily installed or transferred from one frame to another.
Patented
Dial Snap Gages
Comparator (shown here with optional stand), Encased and Decimatic Types
Stock sizes cover range 0" to 8"
Larger sizes available
Adjustable Limit Snap Gages
AGD designs in both regular and midget models.
Also . . . Master Setting Gages
Comparators
Dial Depth Gages
Dial Pin Gages
Adjustable Limit Length Gages
and Others . . .
Write for New Catalog C
STANDARD GAGE CO., INC., Poughkeepsie, N.Y.

Equipment replacement program helps Rockwell maintain leadership

"Since its inception, Rockwell Manufacturing Company has recognized a basic fact of business life — that to maintain leadership it must consistently follow a sound program of equipment replacement. In a multiplant operation such as ours we have the problem of proper allocation of replacement funds. This necessitates careful screening of requests by top management at headquarters in Pittsburgh. The screening function is accomplished by our Budget Committee.

"We believe that personal bias should be eliminated from buying decisions whenever possible. Our policy incorporates two features to safeguard against bias. Each plant has formed a working committee for the study and selection of equipment. This committee consists of the top Design Engineer, Industrial Engineer, Plant Accountant, and the Superintendent. Any replacement must be justified by our "Facility Purchase Formula". This formula weighs the savings and improvement in quality against the depreciation and maintenance costs and return on investments.

"Recommendations for new equipment can be submitted by any department. Our Industrial Engineering staff is specifically charged with the responsibility of continuous review of our equipment, methods and process programs. We believe that these programs will enable us to continue offering our customers the highest quality at the lowest cost."

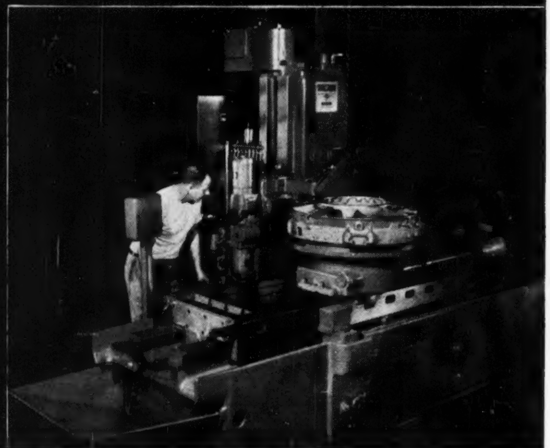
W. F. ROCKWELL, JR., *President*
ROCKWELL MANUFACTURING CO.

ROCKFORD
INSERT
GROUP

Keep Gathering Metal-Working Production Ideas...Be Well Informed When The Time For Replacement Arrives . . . . . .

IF YOU WANT BETTER MILLING METHODS AND LOWER COSTS...

Use Sundstrand Machines and *"Engineered Production" Service*

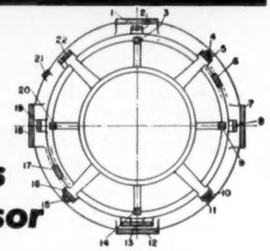


Profitable milling production can be obtained only by lowering unit production costs . . . obtaining the most economical solution to your milling problem and the most productive milling equipment in relation to your production requirements.

Basically, there are two approaches to solving these problems, (1) obtaining standard machines, then trying to process parts over these machines as economically as possible, (2) designing the most profitable processing method, then obtaining machines to suit this method — standard or semi-standard machines, if possible, or entirely special machines, if necessary. This latter method is Sundstrand "Engineered Production" . . . the most practical approach to economical milling. The following is a brief resume of the complete engineering and manufacturing service available from Sundstrand to meet all or any of your production milling requirements in small and medium size work.

These actual examples are presented to reveal one of each of the methods used in solving milling production problems. One of these methods may be the solution to your present problem.

1 Standard Rigidmil Mills 22 Pads On Compressor Frame



This machine is a standard Model 33 Rigidmil equipped with a power vertical feed attachment, an automatic index base controlled from push button station and an automatic quill positioning device. The quill positioning device can be pre-set for 19 automatic depth settings.

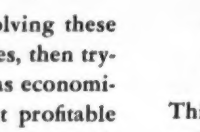
Four different types of cutters are used for the 22 cuts or surfaces machined. The part is located and clamped once but is indexed completely four times with a cutter change at the end of each complete index cycle. To operate the machine, the operator selects the quill position required by the pad presented to the cutter at each index, positions the head vertically by the head jog button and then starts the feed cycle. Table will feed in either direction as required.

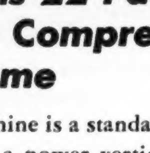
AUTOMATIC LATHES | SIMPLEX RIGIDMILS | DUPLEX RIGIDMILS

SUNDSTRAND

*"Engineered Production" Service**

*REG. U.S. PAT. OFF.

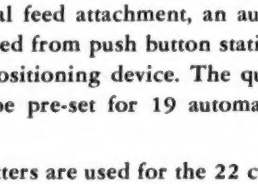


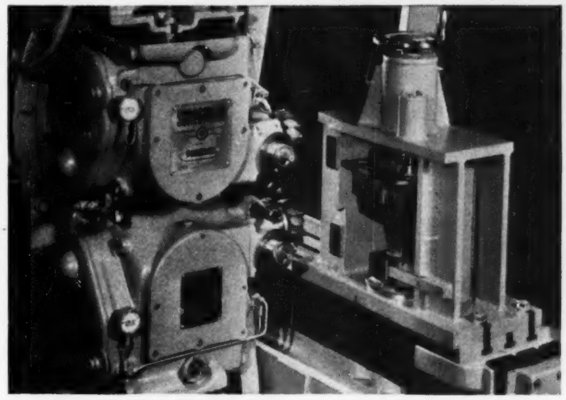


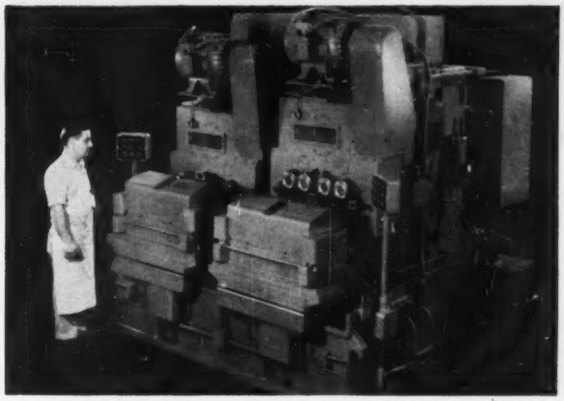
MADE IN

ROCKFORD... TESTED ENGINEERING AND CRAFTSMANSHIP

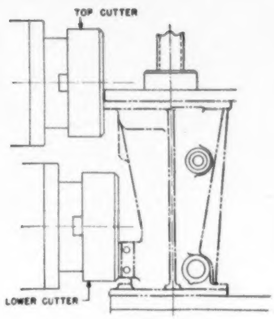
ILLINOIS, U.S.A.



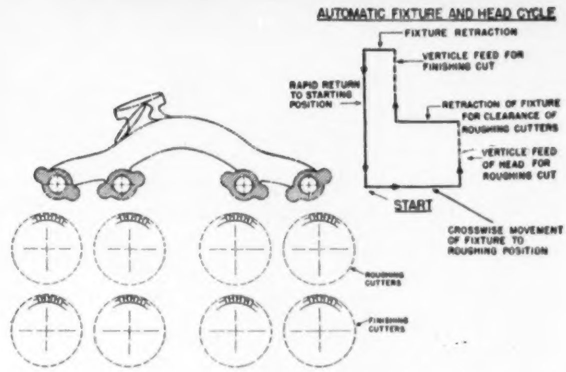




2 Milling 2 Pads at 60 Pieces Per Hour On Semi-Standard Rigidmil



This standard Sundstrand Rigidmil has been provided with two horizontal single spindle heads, one above the other. The two spindles are offset for milling a boss and one edge of flange of bearing retainers. A simple, manually operated work holding fixture holds one piece at a time, and an automatic table cycle of rapid approach, feed and rapid return is used to complete 60 pieces per hour. This is a good example of how a standard Rigidmil can readily be converted to handle special milling jobs.

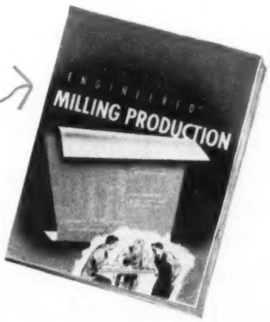


3 Milling 135 Manifold Per Hour On a Special Rigidmil

Here is a special two station Sundstrand Rigidmil that rough and finish mills four port contact faces of exhaust manifolds. Each station has eight spindles, the top four roughing and the bottom four finishing. The machine cycle and surfaces milled at one station is shown in the accompanying tooling diagram. In automatic cycle, controlled by the hydraulically operated work holding fixture, the head rapids up, feeds through the rough and finishing cut and rapid returns. Automatic cutter relief is provided by the fixture. Operator loads and unloads at one station while other station is in operation. Production is 135 manifolds per hour.

Free Data

You'll find plenty of milling methods in this book . . . methods that may provide a short cut or profitable solution to similar jobs in your shop now. Tooling diagrams and machine designs are both included. Write for your copy today. Ask for Bulletin No. 634.

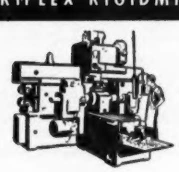


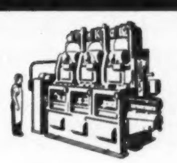
SUNDSTRAND

Machine Tool Co.

2530 Eleventh St. • Rockford, Ill., U.S.A.

TRIPLEX RIGIDMILS | SPECIAL MACHINES





MADE IN

FOR PRODUCTION MACHINE TOOLS IT'S...ROCKFORD

ILLINOIS, U.S.A.

Mattison Grinder beats old time (15 hours) by 12 hours

The picture above shows a punch and die grinding operation on a Mattison High-Powered Precision Surface Grinder at Lyon Metal Products, Incorporated. Previous time on a converted planer-grinder was 15 hours — now with a Mattison Grinder equipped with special fixture, grinding time has been reduced to 3 hours.

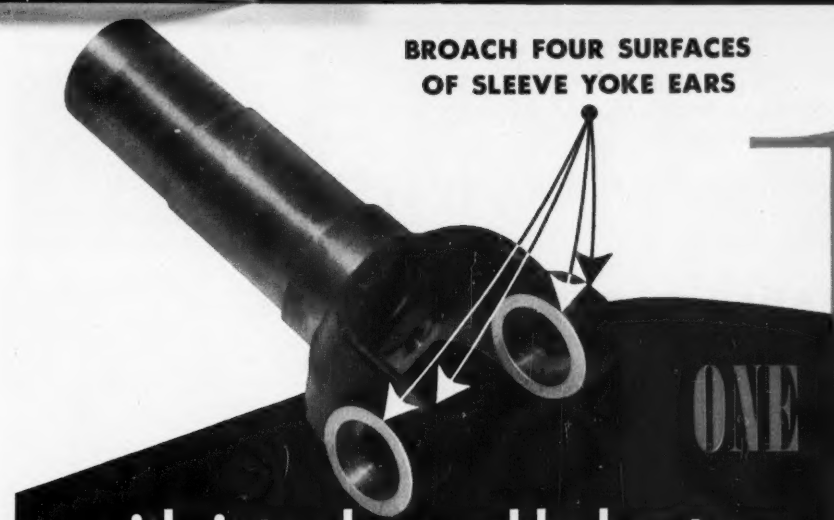
Mattison Grinders are proving profitable investments in plants where "time out" for reconditioning is a vital factor in meeting production schedules. Surfaces are reconditioned and edges sharpened in a minimum of time, eliminating costly delays and holdup of production. Many manufacturers installing the Mattison Grinder for reconditioning dies find many other uses for it in grinding flat surfaces where accuracy and fine finish are required. For complete information on the Mattison High-Powered Precision Surface Grinder, send for free copy of our latest circular.

MATTISON MACHINE WORKS
ROCKFORD · ILLINOIS

MADE IN
ROCKFORD...FOR ACCURATE, FAST METAL REMOVAL
ILLINOIS, U.S.A.

ROCKFORD

BROACH FOUR SURFACES
OF SLEEVE YOKE EARS



ONE MACHINE

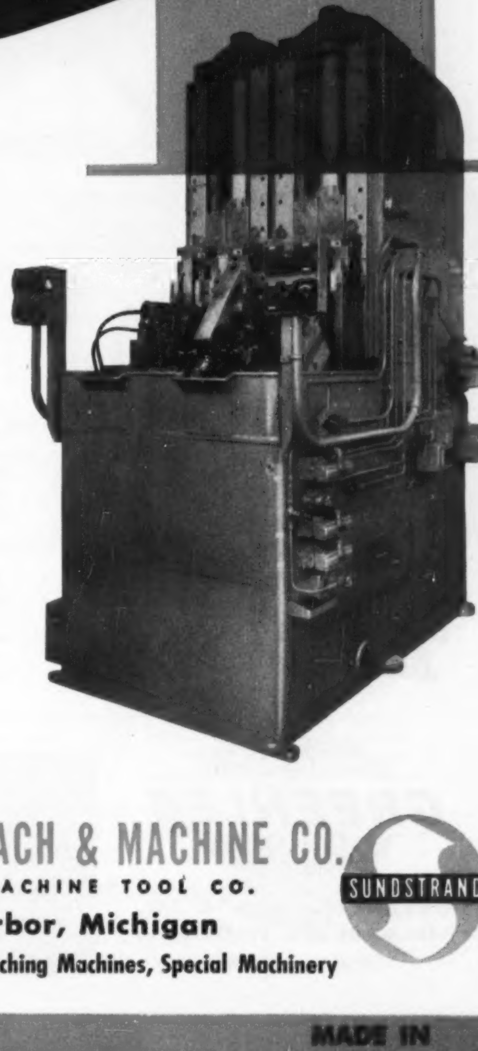
with interchangeable locators broaches 3 similar parts at 500 per hour

THE *American* WAY

Two, two-station base fixtures, mounted on tilting work tables, and arranged with automatic clamping, permit finish broaching the outside and inside faces of the ears on the sleeve yoke parts illustrated . . . at the rate of 500 parts per hour. Interchangeable locators makes it possible to broach any one of three similar parts on this American SBD-48-25 dual ram surface broaching machine.

The savings in time and the resulting low cost per unit are obvious. Such results, however, are typical when American engineers apply the knowledge and experience accumulated during the past 27 years to the practical solution of broaching problems.

Write, sending sample part or detail drawing and mention your hourly requirements. Our Engineering Department will be glad to furnish recommendations for the right machine and the proper tooling. And remember, American manufactures all three . . . broaches, machines and fixtures to give you a properly engineered, balanced solution to your metal removing problems.



AMERICAN

American BROACH & MACHINE CO.

A DIVISION OF SUNDSTRAND MACHINE TOOL CO.

SUNDSTRAND

American Building - Ann Arbor, Michigan

See *American* First — for the Best in Broaching Tools, Broaching Machines, Special Machinery

ROCKFORD

MADE IN

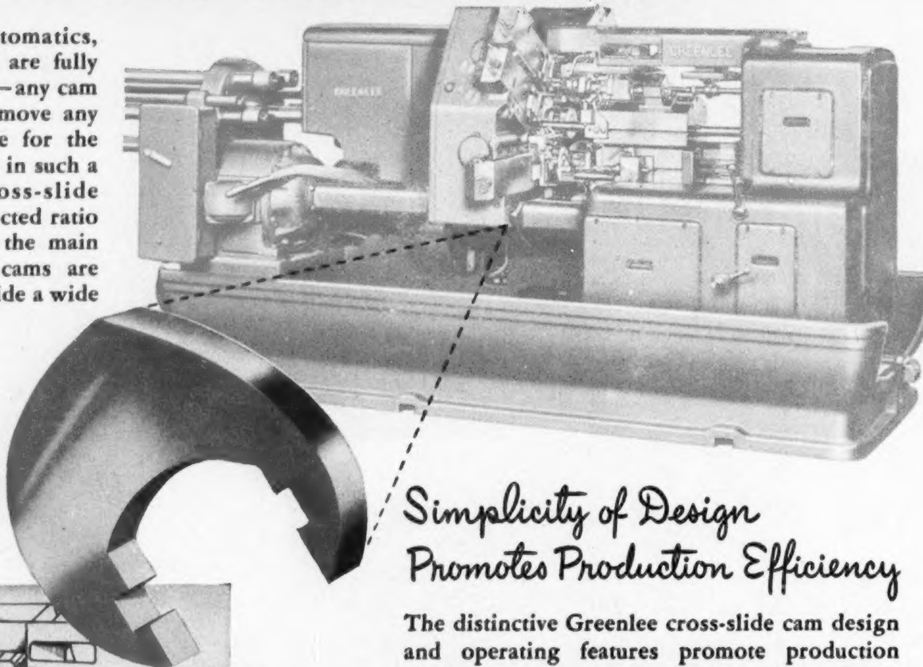
YOU'LL FIND YOUR PRODUCTION MACHINE TOOLS IN... **ROCKFORD**

ILLINOIS, U.S.A.

GREENLEE *Automatics*

INTERCHANGEABLE CROSS-SLIDE CAMS

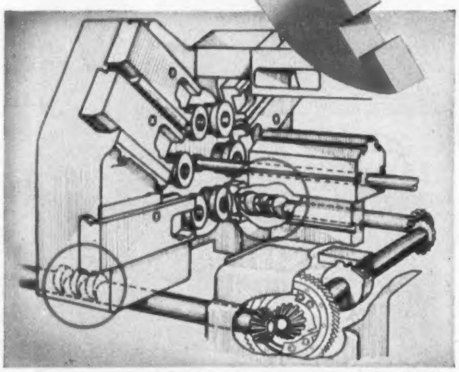
On Greenlee Automatics, cross-slide cams are fully interchangeable—any cam can be used to move any cross-slide. Drive for the cams is arranged in such a way that the cross-slide travel is in a selected ratio to the travel of the main slide. Standard cams are available to provide a wide range of ratios.



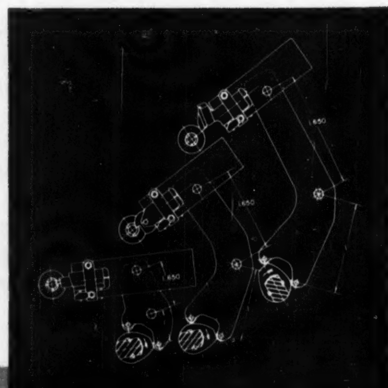
In the average job shop, a set of only 15 standard cams will provide enough flexibility to take care of 90% of the jobs that will come through. Standard ratios range from 1½:1 to 8:1.

Simplicity of Design Promotes Production Efficiency

The distinctive Greenlee cross-slide cam design and operating features promote production efficiency on many short-run jobs because they reduce changeover time. In addition, there is an economy of investment.



As shown at the left, cross-slide cams are located at the sides of the machine, under the open ends of the cross-slide housings, where they are easily accessible.



As shown at the right, each cross-slide is operated independently by a separate cam, making it easier to split up operations and arrange better tooling set-ups.

Write for FREE Literature

PRODUCTION MACHINERY

GREENLEE

G

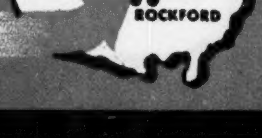
GREENLEE BROS. & CO.
1868 MASON AVE., ROCKFORD, ILL.

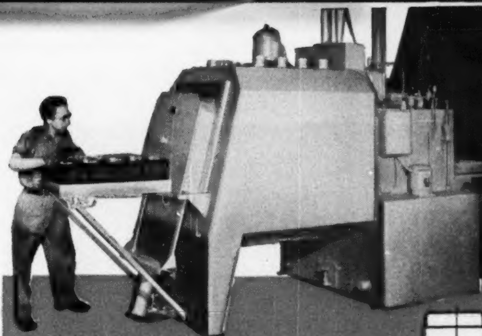
1 Sectional view shows the sliding cam-carrier on shaft with cam and lock-pin removed.

2 Cam slips easily into place on shaft with slots in alignment with keyways.

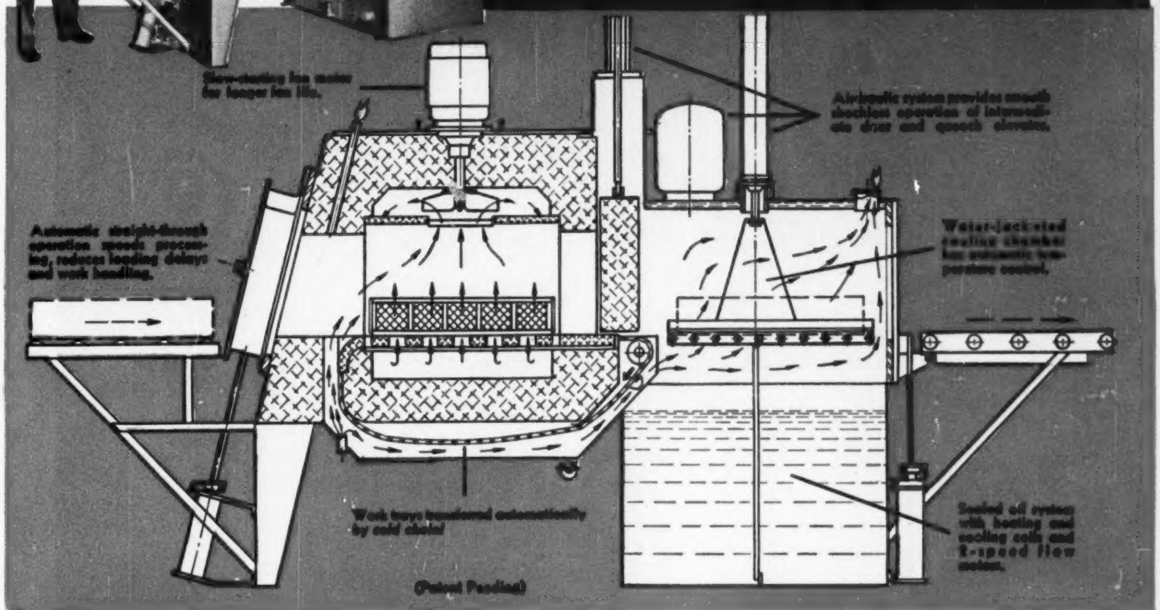
3 The sliding carrier with keys attached quickly locks cam in position on shaft.

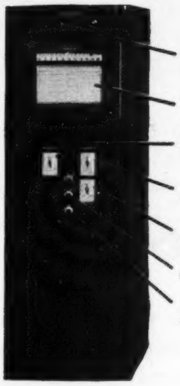
MADE IN
ROCKFORD...MACHINE TOOL SHOPPING CENTER
ILLINOIS, U.S.A.





YOU GET *Uniform Results*
with Ipsen 100% FORCED CONVECTION CONTROLLED ATMOSPHERE UNITS





SIMPLE CHANGE-OVERS
Change-over from one process to another is simple, quick, and easy. Settings for heat, atmospheres, quench, and oil flow is all that is required. Cycle is then controlled automatically.

★Above is a cross-section view of the Ipsen 400 Lb./Hr. Furnace showing the advanced design features which have made Ipsen the largest manufacturer of carbonitriding and batch-type heat treating units. With these new units, you get the advantages of 100% forced convection heating and controlled atmosphere processing, *plus* the full benefits of automatic straight-through operation. Thus, you eliminate loading delays and guess-work. You control distortion and get uniform results from batch to batch . . . today, tomorrow, or next year. You eliminate blasting and pickling operations and you can often use lower grade, less costly steels.

A SINGLE UNIT HANDLES ALL OF THESE OPERATIONS

Unusually versatile, the Ipsen is built for temperatures up to 1850° F., and a single unit is equipped to handle all of the following processes:

ATMOSPHERE COOLING	OIL QUENCHING
Normalizing	General Hardening
Stress Relieving	Carburizing and Hardening
Carburizing	Carbonitriding
Carbonitriding	Martempering

Send **Samples for Free Estimate**— find out how the new Ipsen Units can be applied to your job. Samples of your work will be run, procedures established in our new, modern lab, and cost estimates given without obligation.

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AUTOMATIC **Ipsen** HEAT TREATING UNITS

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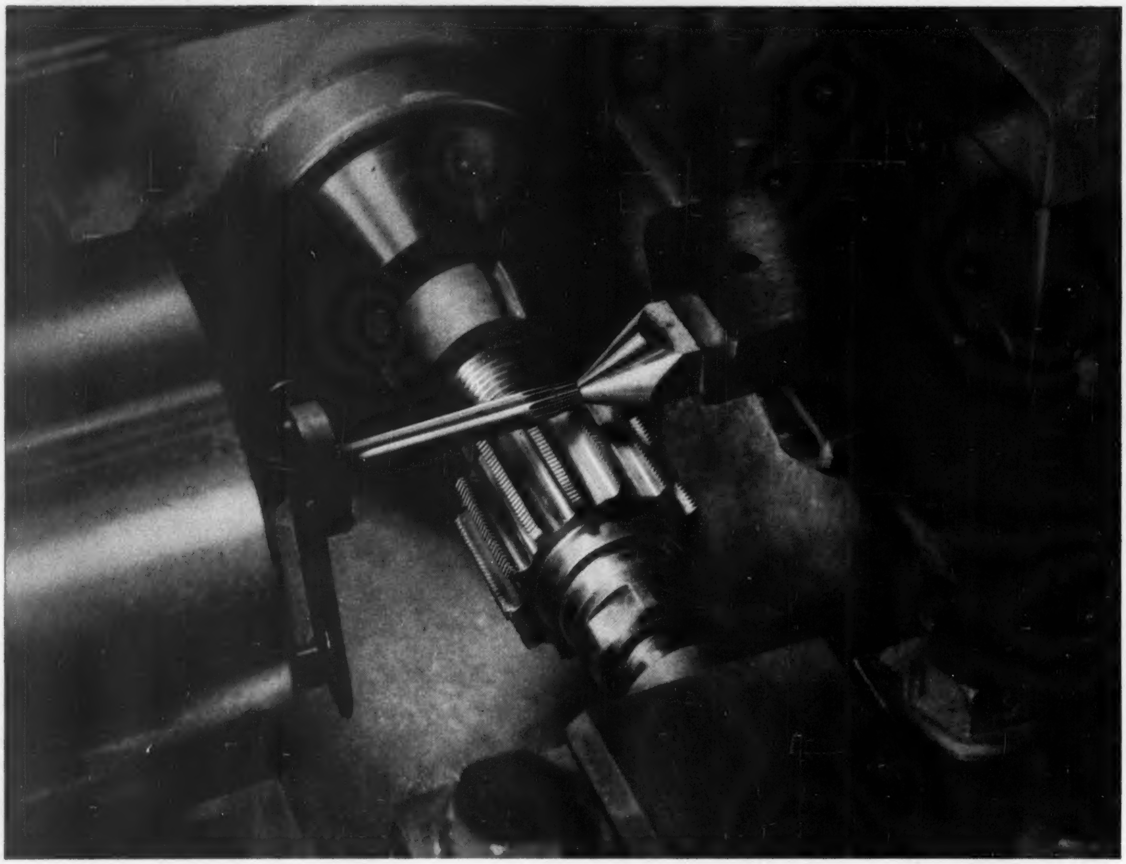
ROCKFORD

ROCKFORD MADE MEANS PRECISION MADE... MADE IN **ROCKFORD** ILLINOIS, U.S.A.



Consistently Better Gears

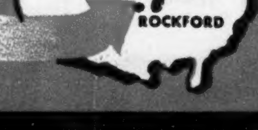
WITH CLASS AA HOBS

Specialists in the field of instrument gears, G-M Laboratories, Chicago, Illinois employ the latest precision techniques to assure consistent accuracy in their work. Their modern gear department is completely temperature and humidity controlled, and Precision Type Barber-Colman Hobbing Machines are used.

To produce the finest gear accuracy, this firm has standardized on the use of Class AA hobs with taper bores for their precision work. Experience has shown that Barber-Colman Precision No. 6-10 Hobbing Machines, in combination with Class AA hobs, give them the most accurate tooth form and spacing. All gears are finish hobbed, without further finishing operations. Tolerances on the pinions shown here consistently check within .0003″ tooth-to-tooth composite error, and .0006″ total composite error.

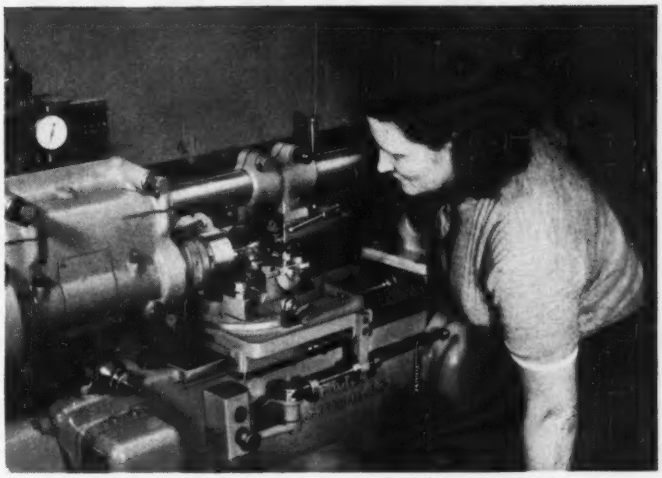
B U I L D E R S O F P R E C I S I O N G E A R

MADE IN
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.



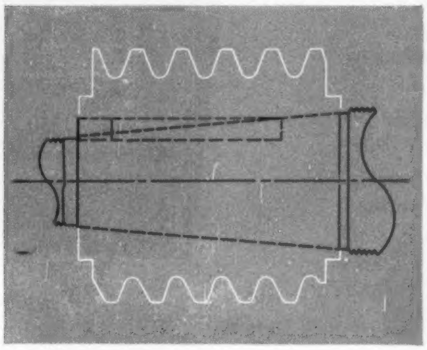
GREATER NUMBER OF CLOSE TOLERANCE GEARS USING CLASS AA HOBS

Although the hob is not the only factor affecting the accuracy of gears, it does have an important effect, particularly upon the profile of the gear tooth. Class AA hobs are made to consistently closer tolerances than any other hobs, and have proved themselves in actual production for many years. Performance records show that, per sharpening, Class AA hobs produce more gears with close tolerances than any other hobs.



Class AA hobs are recommended for the utmost in precision, where other conditions warrant the use of a tool of this class. This accuracy in the tool, however, may be lost if the hob is not properly mounted or trued on the machine. Because of this, Class AA hobs are recommended with taper bores. The taper makes it much easier to true hobs on the arbor where high accuracy requirements are demanded. Compared with the sliding contact on straight hole hobs, the taper provides metal-to-metal contact, eliminating the possibility of an increase in runout during the cutting operation. Time is also saved for the operator because the hob will run as true as the spindle.

TAPER BORES RECOMMENDED . . .



Production-line accuracy in all metal cutting operations is constantly approaching closer limits, Gear hobbing is perhaps the outstanding example. When you have gear tooth problems be sure to ask Barber-Colman Hobbing Engineers to work with you. Their long experience in gear cutting is available to you without cost or obilgation.

Write for a copy of Hobbing Notes — *"Hobbing Accurate Gears"*

HOBS • CUTTERS • REAMERS
HOBBING MACHINES
HOB SHARPENING MACHINES

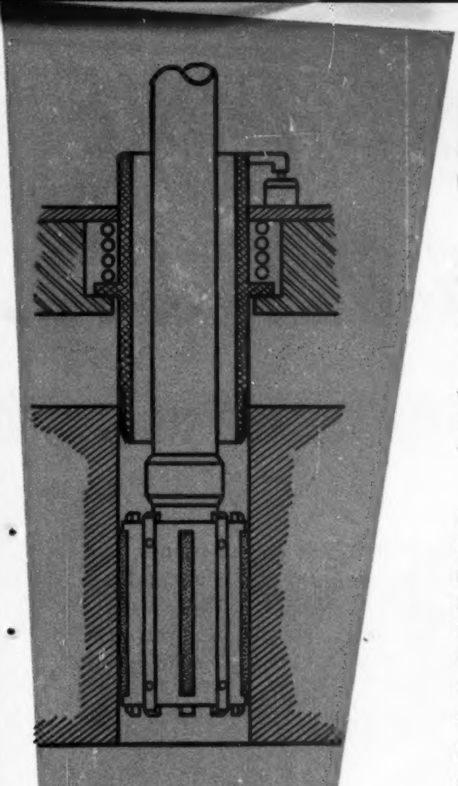
BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 728 ROCK STREET, ROCKFORD, ILLINOIS

HOBS AND MACHINES SINCE 1911

CENTER OF MACHINE TOOL EXCELLENCE... MADE IN ROCKFORD ILLINOIS, U.S.A.



NEW

Plugmatic Bore-to-Bore Sizing Gauges Honed Bore Directly. Provides New Standard for Production Accuracy.

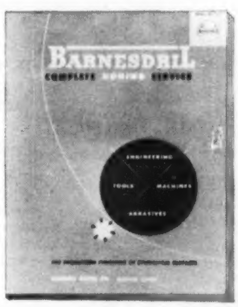
BARNESDRIL design and development has also produced Plugmatic Bore-To-Bore Sizing, the most positive and accurate sizing method yet introduced. The entire sizing operation is now simplified and is not affected by eccentric or uneven stone wear. The Honed bore is positively gauged and directly controls the termination of the honing cycle as the predetermined size is reached.

Simple in operation and design, a master gauge is positioned in a floating holder with a self-leading nose. When final size is reached, the gauge drops into the bore and by electric controls terminates the honing cycle.

BARNESDRIL Plugmatic Sizing is not affected by the angle of operation and is equally effective for vertical, angular or horizontal applications. It provides one type of sizing for regular, counter-bored or blind-end bores.

Longer tool life, faster stock removal and positive automatic bore sizing are obtained with these new **BARNESDRIL** Honing Tools. Get in touch with your **BARNESDRIL** representative for assistance on your finishing operations or write directly to **BARNESDRIL** engineering department.

Get This New Bulletin on Complete Honing Service. Copy Mailed Upon Receipt of your Letterhead Request.



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INGERSOLL

MICROMILL
.010" STOCK

SHEAR CLEAR
2½" STOCK

ABOVE: Milling a cast steel turbine shell, this carbide-tipped Ingersoll Shear Clear Face Mill removes 2-1/2" stock in three heavy cuts, using up to 150 hp.

LEFT: In finishing the joint surface, only .010" stock is removed by the Ingersoll MicroMill, but it produces a 50 microinch finish, thus eliminating most of the hand-scraping previously required to make the joint steam-tight.

Each of these wholly different cutters adds in its own way to the earning power of a large Ingersoll Milling Machine, built to efficiently mill cast steel turbine shells.

The Ingersoll Shear Clear utilizes the full capacity of the machine for rapid removal of metal.

The Ingersoll MicroMill takes full advantage of the machine's ability to do highly accurate work.

Ingersoll's ability to furnish the cutting tools needed to obtain maximum effectiveness from all kinds of milling and boring equipment is available to you.

WRITE TODAY FOR NEW INGERSOLL CUTTER CATALOG NO. 60B

THE INGERSOLL MILLING MACHINE COMPANY, ROCKFORD, ILLINOIS

MADE IN
ROCKFORD...MACHINE TOOL PLANTS CLOSE TO YOUR PLANT
ILLINOIS, U.S.A.

ROCKFORD

TOOL ROOM OR PRODUCTION—

SPEEDS FOR CARBIDE TOOLS—

MEDIUM SIZE CAPACITY—

With FEATURES AND RANGE NORMALLY FOUND IN LARGER LATHES

Usually only in larger, more costly machines do you find the combination of speeds, swing, power, feeds and threads that are standard equipment on Rockford Economy Lathes. These features make it possible to machine a wider range of work with fewer non-productive hours than is possible with many machines in its class.

Medium-sized and economy-priced, it's built to handle any job that can be turned or threaded within 16-1/2" or 18-1/2" swing, and 30" to 102" center distance. 3100 lbs. of weight, 6' bed and zero precision bearings furnish the rigidity and precision for turning out tool room accuracy.

Ask a Rockford Machine Tool Co. representative to give you full details on these machines, or write direct for our new bulletin No. 900B.

ROCKFORD ECONOMY LATHES—16" and 18"

MEDIUM-SIZED

529

ECONOMY-PRICED

ROCKFORD MACHINE TOOL CO.
2500 Kishwaukee Street, Rockford, Illinois

MADE IN
ROCKFORD...A CONVENIENT SOURCE FOR PRODUCTION NEEDS
ILLINOIS, U.S.A.

ROCKFORD

These are the parts:

1. Diesel injection pumps
2. Lathe centers
3. Slitting rolls and knives
4. Cam rollers for automotive steering gears
5. Machine tool parts
6. Pump parts
7. Aircraft engine parts
8. Mechanical seals
9. Saw mill rollers
10. Ball bearings
11. Asbestos disintegrators
12. Mill rolls

This is the steel:

52100

52100 is the ideal steel for the parts listed above because it's hard . . . it's tough . . . it's easy to machine! It is widely used for machined parts requiring great strength and exceptional wear resistance.

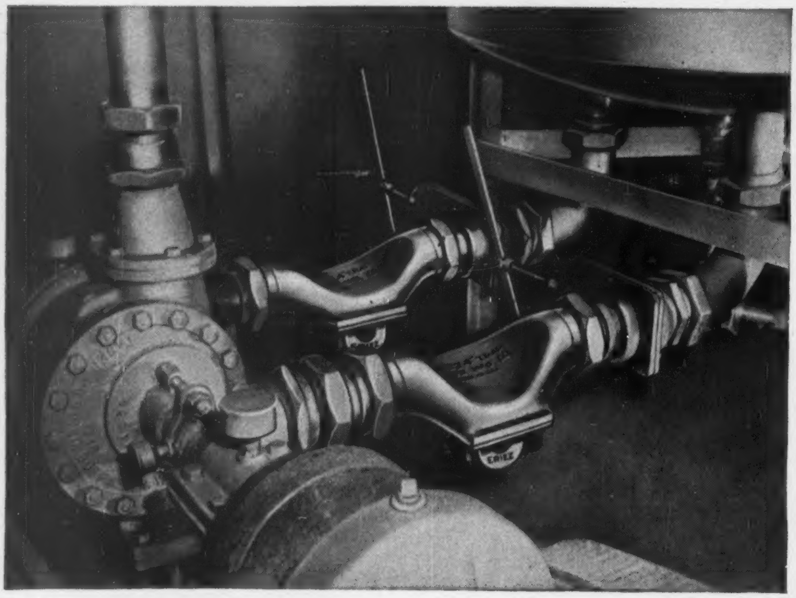
An alloy steel of high-carbon analysis, 52100 has high tensile and fatigue strength. It's fully spheroidized structure makes machining easier. And 52100 withstands a working pressure of 200,000 p.s.i., can be oil quenched to a maximum hardness of 65/66 Rockwell C.

You can get 52100 in *all three* finished forms—bars, tubes, wire—from the Timken Company, one of the world's largest producers of 52100. For small run or emergency requirements, the Timken Company maintains a mill stock of 101 sizes in 52100 tubing—from 1″ to 10½″ O.D. And you're assured of uniform quality in every shipment because of rigid quality control at every step in production.

For a stock list of available sizes, grades and finishes, write The Timken Roller Bearing Company, Steel and Tube Div., Canton 6, O. Cable address: "TIMROSCO."

YEARS AHEAD—THROUGH EXPERIENCE AND RESEARCH

SPECIALISTS IN FINE ALLOY STEELS, GRAPHITIC TOOL STEELS AND SEAMLESS TUBING



ERIEZ MAGNETIC PIPELINE TRAPS, widely used in the process industries, provide the superior magnetic strength of a high nickel alloy . . . ALNICO . . . to assure positive trapping of tramp iron. Housings are non-magnetic chromium-nickel stainless steel castings . . . leak-proof, easy to install and simple to clean. Completely non-electric . . . first cost is last cost . . . since magnets hold strength during life of equipment.

1,045 PIECES OF TRAMP IRON REMOVED ahead of vane-type displacement pump in food production line during a 30-day period, by an ERIEZ Permanent (non-electric) Magnetic Pipeline Trap.

Prevent

→ ***Machinery Damage***

→ ***Product Contamination***

→ ***Production Tie-Ups***

. . . Automatically, with Eriez Magnetic Traps

Look at this pile of tramp iron . . .

Trapped ahead of a pump in a large food plant during a 30-day processing period . . . it exemplifies how "protection plus" is obtained automatically with pipeline traps produced by ERIEZ MANUFACTURING COMPANY, Erie, Pa.

To keep liquid flow lines free of ferrous materials ranging in size from minute particles to large pieces of tramp iron, ERIEZ pipeline traps utilize the strong magnetic properties of Alnico permanent magnets containing a high percentage of nickel.

Use of this aluminum-nickel-cobalt-iron alloy not only permits trap designs that eliminate need for electromagnets requiring current and accessory equipment, but its use also allows reduction of space and weight requirements to desirable limits.

The addition of nickel . . . an essential in Alnico . . . improves scores of other alloys utilized throughout industry. Consult us on use of nickel or nickel alloys in your products or equipment.

Send details of your metal problems for our suggestions.

At the present time, nickel is available for end uses in defense and defense supporting industries. The remainder of the supply is available for some civilian applications and governmental stockpiling.

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THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

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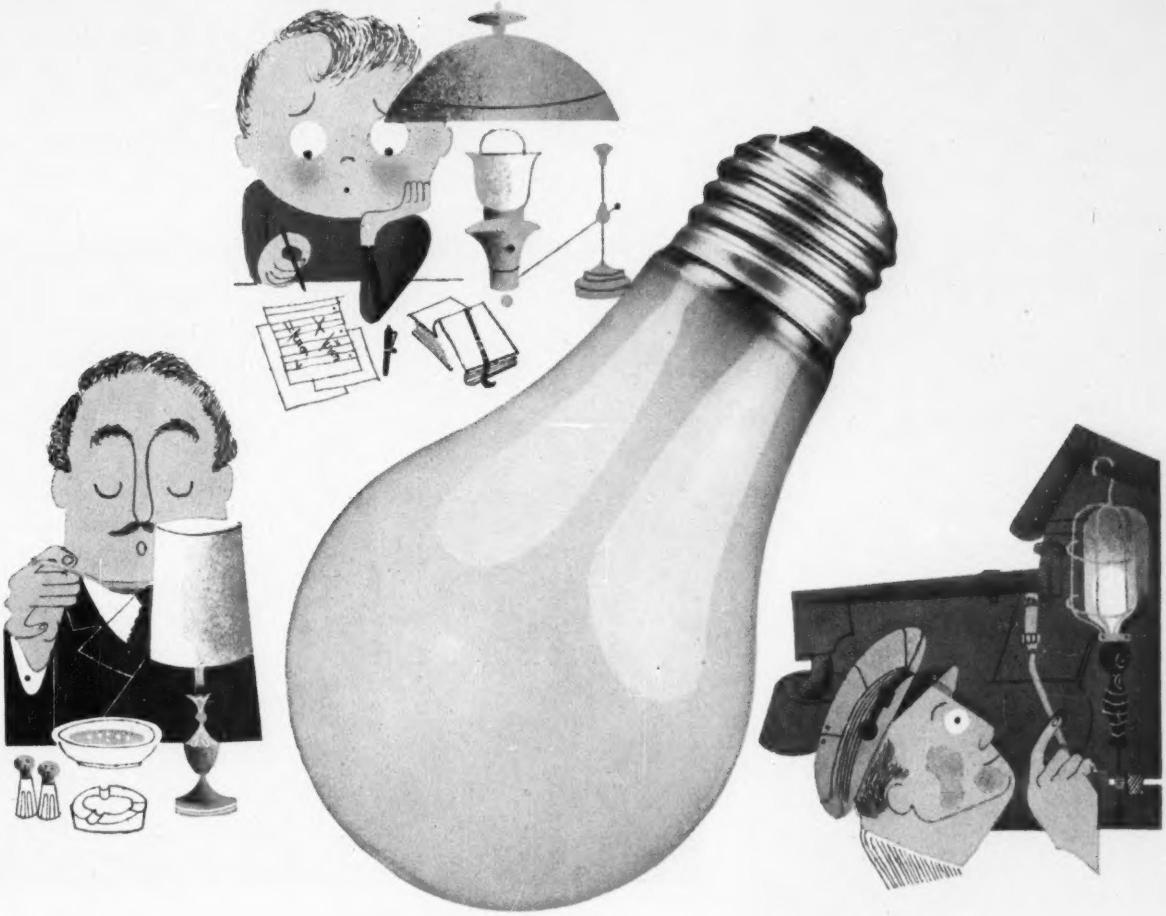

and in any location

REX HIGH SPEED STEEL *is always the same, too*

Crucible's REX High Speed Steels are the same no matter where or in what form you buy them. That's because their quality is thoroughly checked through every phase of manufacture . . . from melting to the last finishing operation. This persistent attention to quality assures you that all REX High Speed Steels are uniform.

And it's readily available. All Crucible warehouses, which are conviently located throughout the country, are well stocked with REX AA, REX M2 and other grades of this quality brand. Next time you need high speed steels, call Crucible.

WRITE TODAY for the unique Crucible Tool Steel Selector, 9" diameter, in 3 colors — a twist of the dial tells you which tool steel is best for your application. Address your request to Crucible Steel Company of America, Dept. M, Oliver Building, Pittsburgh 22, Pa.

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AirKool Die Steel
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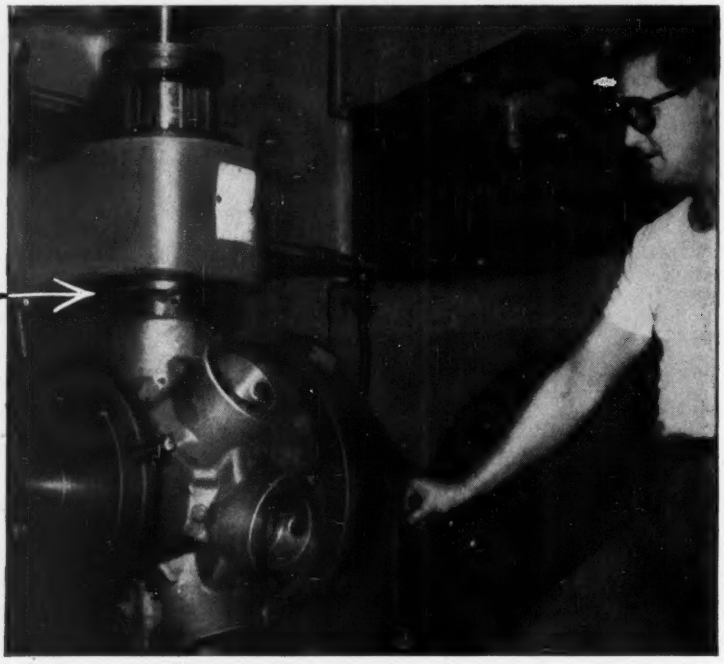
2000 Cylinder Ports per Grind

because **HAYNES STELLITE** *tools resist* **CHIPPING and SPALLING**



This boring head, containing 20 HAYNES STELLITE inserted blades, operates for 4 to 6 weeks without grinding.

Here is how the HAYNES STELLITE blades are positioned in the boring head.

A multiple blade boring head containing 20 HAYNES STELLITE alloy inserted blades operates from 4 to 6 weeks without regrinding at a plant making refrigeration and air-conditioning equipment. The tools bore, chamfer, counterbore, drill, and face the cylinder ports in cast iron compressor heads. This is all done in one operation.

HAYNES STELLITE blades average over 2000 cylinders per grind even though machining is complicated by an intermittent cut at a gas outlet port in the cylinder wall. The tools are good for 25 regrinds—an average of 50,000 cylinders per cutter.

Tools made of HAYNES STELLITE alloy resist chipping and spalling—even on tough jobs like this one. This is one reason why the tools are easy to grind and can be reground so many times.

For information on how to use HAYNES STELLITE tools on your machining jobs, write for the booklet "HAYNES STELLITE Metal-Cutting Tools." It gives helpful information on chip formation, tool design and the machinability of metals.

HAYNES TRADE-MARK *Alloys*

Haynes Stellite Company
A Division of
Union Carbide and Carbon Corporation
UCC
General Offices and Works, Kokomo, Indiana
Sales Offices
Chicago — Cleveland — Detroit — Houston
Los Angeles — New York — San Francisco — Tulsa

"Haynes" and "Haynes Stellite" are trade-marks of Union Carbide and Carbon Corporation.

Aluminum chips are no problem when you follow simple procedures

Knowing the type of chip that each Alcoa alloy produces will simplify your machining. For example, 11S-T3 machines fastest, breaks into small chips. 17S-T4 and 24S-T4 produce tougher chips that require simple practices in tooling and setup to keep the tool zone clear.

On your cutoff, form and box tools, grinding chip grooves and proper rake angles will help control chips. Small rake angles for 11S-T3 produce small chips. Chip grooves, ground with a pencil wheel or the corner of a large wheel, will increase the rake and curl the chip tightly. Drill flutes should be large and polished. In deep-hole drilling, use several drills or back out the drill to clear the chips. Use a large volume of coolant instead of thin, high-speed streams. Direct the flow to wash away the chips and keep the tools and work cool.

Your local Alcoa sales engineer will answer your questions on machining, alloy selection and finishing. You'll find him listed under "Aluminum" in your classified phone book. Aluminum Company of America, 870-H Alcoa Building, Pittsburgh 19, Pa.

ALCOA OFFERS TWO BOOKS *Alcoa Aluminum in Automatic Screw Machines*—a 95-page book containing information on tool design, setup and operating techniques. *Corrected Tool Diameter Tables*—a 64-page book giving corrected tool diameters for circular form tools and flat form tools under conditions of 0°, 5° and 10° top rake.

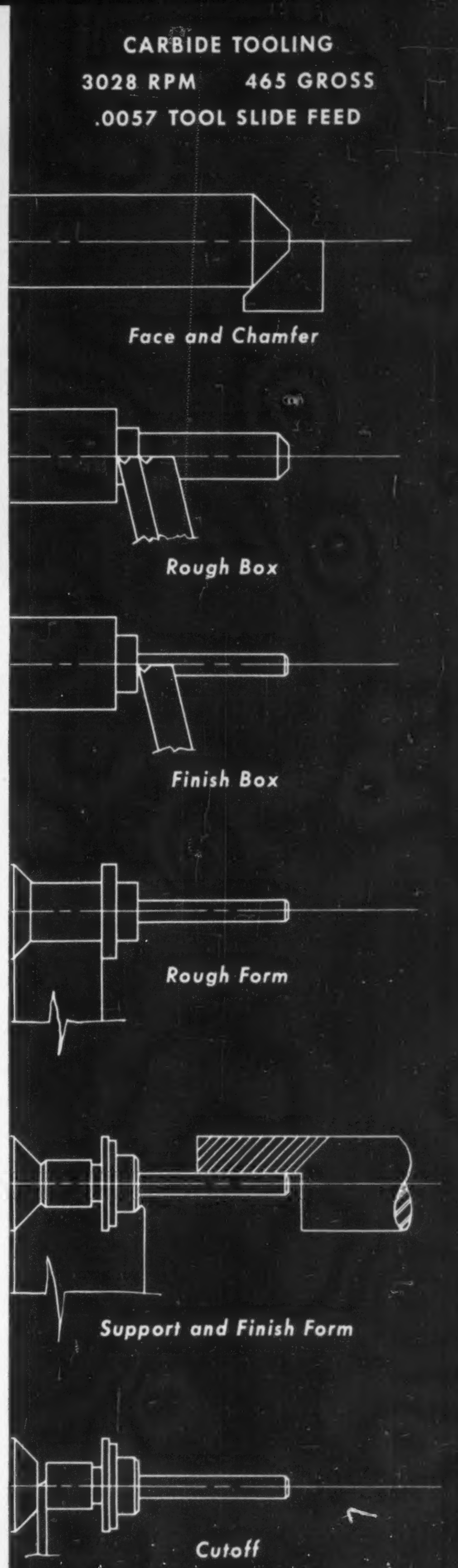
BASIC ECONOMICS FOR BUYERS

While you buy screw machine stock by the pound, you machine it by the foot. A pound of aluminum gives you three times more feet of stock than a pound of brass or steel.

Alcoa Aluminum

ALCOA ALUMINUM ®

ALUMINUM COMPANY OF AMERICA



RECENT INTERESTING DESIGNS

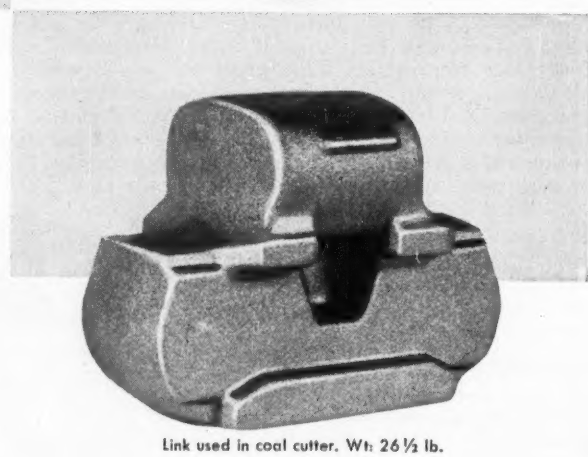
Aircraft strut part. Wt: 8 ¼ lb.

from the Bethlehem Drop Forge Shops

Fulcrum for internal combustion engine. Wt: 4 lb.

Arm for aircraft aileron control. Wt: 6 ½ lb.

Blank for high-speed gear. Wt: 2 ½ lb.



Link used in coal cutter. Wt: 26 ½ lb.

Every working day of the year the Bethlehem drop forge shops turn out a steady stream of interesting designs; some simple, some complex, but all produced with the same exacting care. A recent group is pictured here, and as you can see, the pieces are meant for use in widely different industrial fields.

These of course are but a few—a tiny fraction—of the huge number of sizes and types that Bethlehem makes. We are equipped for closed-die forgings ranging in weight from several ounces to well over 200 lb—forgings available in carbon or alloy steel, untreated or heat-treated.

Why not let us see prints of the next design you expect to order? We handle all production details, including the sinking of the dies, in a way to please the most particular buyer.

Bethlehem facilities for the making of closed-die forgings include steam and board drop hammers, 1500 to 8000 lb; mechanical presses to 3000 tons; upsetters 9 in. and smaller.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

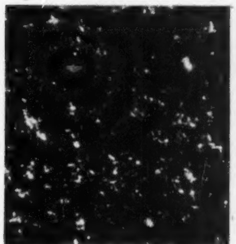
BETHLEHEM STEEL

Heavy Zinc Phosphate Coatings for Steel

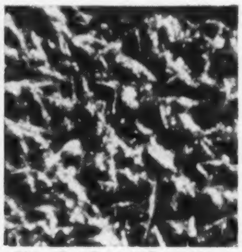
In developing the Oakite CrysCoat HC* Process—which converts a steel surface into a continuous coating of complex metal phosphates—the chemists of the Oakite Research Laboratory made use of a chemical reaction which conquered some of the major obstacles that interfered with the success of older phosphating processes.

The primary aims of this research were to produce a phosphate coating that would provide a good foundation for paint and would give the steel reliable protection against electrochemical corrosion.

These aims were realized with a coating—composed principally of zinc phosphates—that weighs more than 200 milligrams per square foot, thus exceeding the requirements of U.S. Government Specifications JAN-C-490, Grade 1; 57-0-2C, Type 2, Class C and PA-PD-191, Rev. A. In regard to corrosion, the test panels usually run well over 500 hours in the salt spray chamber without showing any signs of blistering or peeling in the types of paint ordinarily used in ordnance production.



Without a phosphate coating, cold-rolled steel possesses poor paint-bonding characteristics and no protection against electrochemical corrosion.



This CrysCoat HC coating of phosphate crystals protects against corrosion and provides an excellent foundation for paint. Magnified 67.5 times.

Secondary aims of the research were to develop a process that would produce little sludge and scale, that would not require overly expensive equipment and that would be easy to control.

While all of these aims were accomplished, the most remarkable gains were made in the field of control.

Perhaps the best way to describe the simplicity of the Oakite CrysCoat HC Process is to say that it requires no skilled chemist to serve as baby-sitter.

Only one material—the liquid called Oakite CrysCoat HC—is used in the phosphating stage. No other material—such as accelerator, starter, toner or other additive—is used for making up the solution or for keeping up its concentration.

Only one type of titration is needed to keep the CrysCoat HC process under control and there is no need for regular determination and adjustment of pH.

More information about the simplicity and reliability of the Oakite CrysCoat HC Process is given in a 12-page, illustrated booklet titled *"How to apply better zinc phosphate coatings to steel in preparation for painting."* To obtain a free copy, mail the coupon at the right.

At Consolidated Industries, Lafayette, Ind., Superintendent Edwin Everhart and Oakite Technical Service Representative Walter Sittman watch part of a disposable gas tank go into the CrysCoat HC solution.

*HC means Heavy Coating

Advertisement

WHAT'S THE BEST WAY TO APPLY ZINC PHOSPHATE COATINGS TO STEEL?

OAKITE CRYSCOAT HC DOES A FINE JOB FOR US*

*This comment came from a Pennsylvania munitions maker, who added that Oakite CrysCoat HC has put an excellent zinc phosphate coating on 385,000 shells with "absolutely no trouble . . . maintenance and control are very easy."

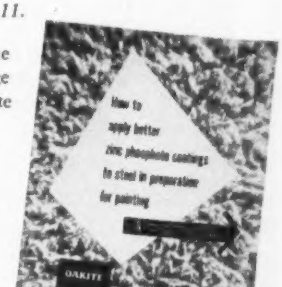
The Oakite CrysCoat HC coating on steel products—such as artillery shells, rocket fins, auto parts, etc.—weighs more than 200 milligrams per square foot. It more than meets the requirements of U. S. Government Specifications:

JAN-C-490, Grade 1 | **57-O-2C, Type 2, Class C** | **PA-PD-191, Rev. A**

The Oakite CrysCoat HC Process for preparing steel for painting—either in spray-washing machines or in tanks—has five big advantages:

1. The heavy CrysCoat HC coating forms a strong foundation for the lasting adhesion of paint. *See page 5 in free booklet.*
2. The heavy coating gives excellent protection against electrochemical corrosion. *See page 7.*
3. The CrysCoat HC Process is easy to control. Only one material is used for make-up and up-keep. No accelerators, starters, toners or other additives are needed. Only one simple type of titration is used. *See page 9.*
4. The CrysCoat HC reaction produces relatively little sludge and scale. *See page 10.*
5. Stainless steel is not necessary for all parts of the equipment. *See page 11.*

FREE For complete information, mail the coupon for a copy of our 12-page illustrated booklet describing the Oakite CrysCoat HC Process.



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Send me a FREE copy of *"How to apply better zinc phosphate coatings to steel in preparation for painting."*

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Company ______________________

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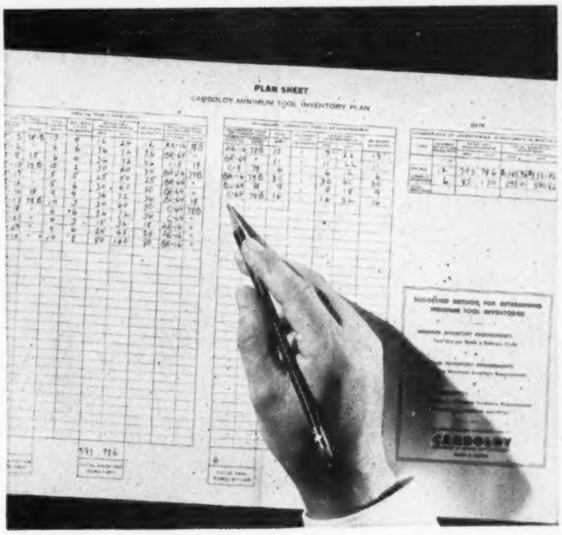
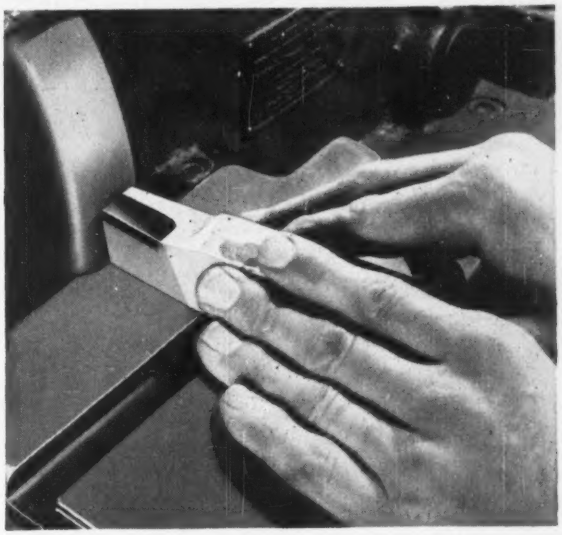
inventories of tools now unnecessary"





2. **With the handy Plan Sheet provided,** you'll quickly get a dollars-and-cents answer showing how much you'll save by standardizing. Simple subtraction shows you how much your inventories can be cut by using standards.

3. **Order the Standard Tools** you'll need from your local Authorized Carboloy Distributor. Use them "as is," or quickly grind them to your specifications. Grinding hints, price lists and Standard Tool specifications are included in Kit.

Send coupon—pinned to your company letterhead—for your free MTI Plan Kit

AUTHORIZED CARBOLOY® DISTRIBUTORS
TRADEMARK
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CARBOLOY TOOLS ARE STOCKED COAST TO COAST

Look under "Tools" in the Yellow Pages of your local telephone book or in Thomas' Register for your nearby Carboloy Distributor. He has complete local stocks and services. Ask him about the MTI Plan.

CARBOLOY
DEPARTMENT OF GENERAL ELECTRIC COMPANY
11147 E. 8 Mile Street, Detroit 32, Michigan

- ☐ Please rush me, at no cost or obligation, MTI Plan Kit
- ☐ Have your sales representative call to show me the Kit, without obligation
- ☐ Send me the new, free Brief-A-Log GT-265, containing complete specifications and prices of Standard Carboloy Tools and Blanks

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WHAT'S YOUR GUESS ON THIS

Machinability Comparison?

ENDURO STAINLESS STEEL BARS ARE —% AS MACHINABLE AS BESSEMER SCREW STOCK

Would You Say

(a) *42%* (b) *67%* (c) *100%*
(d) *33%* (e) *90%*

?

YOU CAN APPLY the high physical and chemical properties of ENDURO Stainless Steel to duplicate parts you're running now —and still get fast automatic production.

Free-Machining ENDURO Bars are cold-finished by Republic's Union Drawn Steel Division especially for that purpose. They provide close tolerances, accuracy of section, uniform soundness, and fine surface finish.

Two grades are fully 90% as machinable as Bessemer screw stock. If 90% was your answer to the question above, you've probably had experience with Free-Machining ENDURO Bars. If you haven't, Republic metallurgists will be glad to give you prompt assistance on applications, processing, and use. Free-Machining ENDURO also is available in hot-rolled bars and in wire. Get more details from your nearest Republic District Sales Office, or write:

REPUBLIC STEEL CORPORATION
Alloy Steel Division • Massillon, Ohio
GENERAL OFFICES • CLEVELAND 1, OHIO
Export Department: Chrysler Building, New York 17, N.Y.

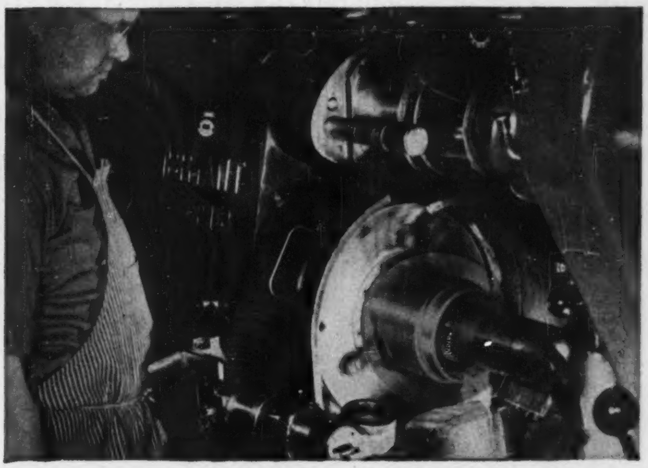
Republic ENDURO® FREE-MACHINING STAINLESS STEEL

REPUBLIC STEEL®

Other Republic Products include Carbon and Alloy Steels—Pipe, Sheets, Strip, Plates, Bars, Wire, Pig Iron, Bolts and Nuts, Tubing

High production hits its peak when the "Touch of Gold" is added with Norton G Bond wheels for internal grinding.

Precision-processed for identical top performance, Norton G Bond wheels help cut costs on this centerless internal grinding job.



A faster, better finish on this aircraft engine cylinder is assured. Norton G Bond internal grinding wheels are on the job!

Step up your internal grinding... boost your profits...with this new

"TOUCH OF GOLD"

Norton G BOND wheels are precision-processed for identical precision-performance

If you haven't tried the new Norton G Bond wheels you have a real thrill coming!

In the first place, these wheels are built by Norton's exclusive method of *precision-processing.*

This brings you wheels so completely uniform in structure that you can just pull off a worn out wheel and slip on a new one knowing you'll get exactly the same grinding action you had a few seconds before, the day before or the week before. Eliminating the fussing with the timing cycle, they save you time and money on every job.

Added to this, the new Norton G Bond, designed for precision and semi-precision grinding, is one of the greatest advancements in vitrified bonds ever made. Holding each abrasive grain for maximum cutting action, it lets go just when it should — assuring a constant grinding surface of fresh, sharp cutting edges.

Top performers . . . all the way

As a result, Norton G Bond internal wheels are exceptional in every detail of operation. They cut cooler . . . remove material faster . . . produce a better finish . . . produce more pieces per dressing . . . hold their shape better. In your internal grinding these advantages add the true "Touch of Gold" that means more accurate work, better products and lowered costs.

Thoroughly job-proved

Performance tells the story. Here are some typical reports from internal grinding customers after switching to G Bond wheels: *Total pieces per wheel jumped from 200 to 400 . . . Twice as many roller bearing races ground per dressing . . . Grinding cycle reduced from 7/10 minute to 4/10 minute, with pieces per dressing increased 50% . . . Pieces per dressing increased from 9 to 15.*

See your Norton distributor

for further facts on how this value-adding, profit-boosting "Touch of Gold" can be brought to your own internal grinding applications. He'll be glad to arrange a test in your plant. Or write to NORTON COMPANY, Worcester 6, Mass. Distributors in all principal cities — listed under "Grinding Wheels" in your telephone directory yellow pages. *Export:* Norton Behr-Manning Overseas Incorporated, Worcester 6, Mass.

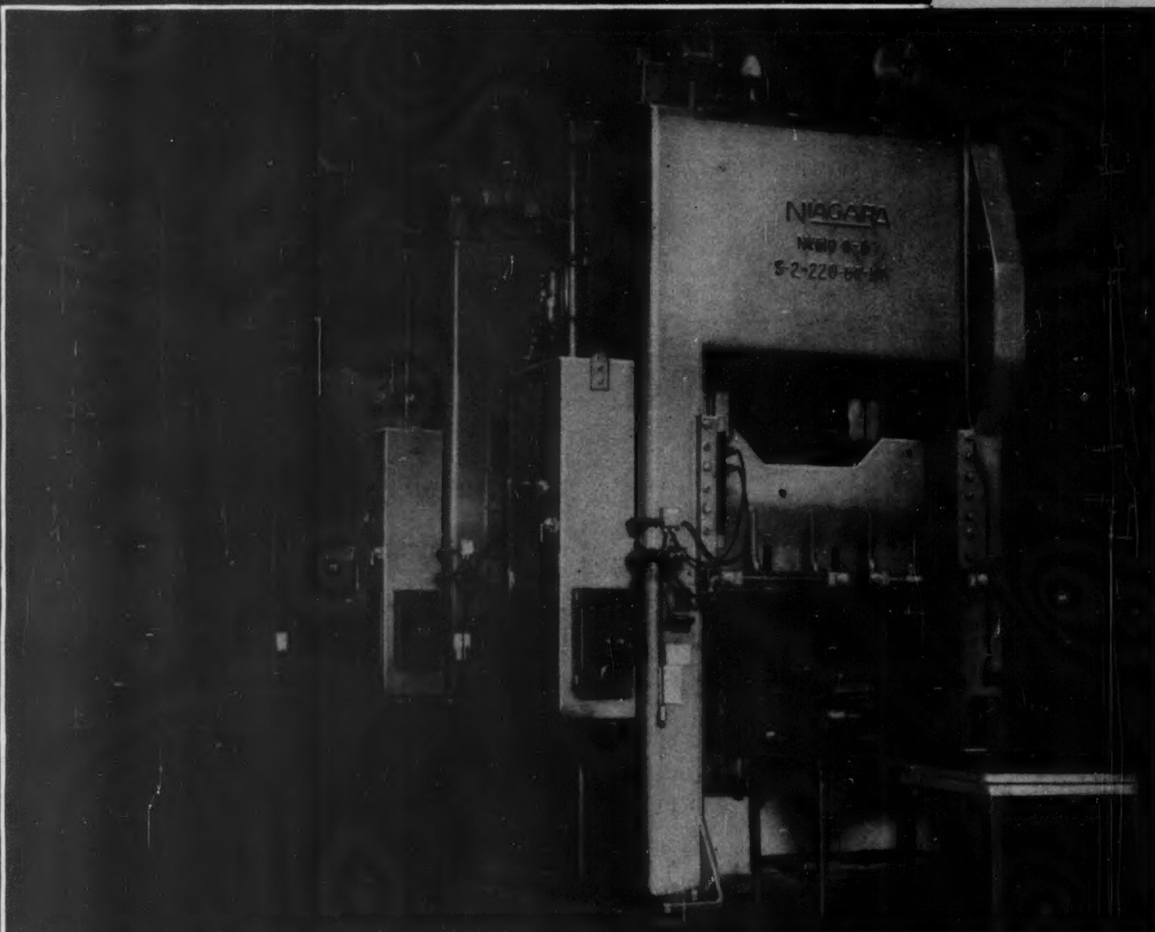
W—1505

NORTON

ABRASIVES

Making better products... to make other products better

NIAGARA



Typical production line of Niagara Straight Side Double Crank Presses in one of America's foremost automotive plants.

NIAGARA MACHINE & TOOL WORKS · BUFFALO 11, N. Y.

straight side double crank PRESSES

Speeding up Production in Large Automotive Plants

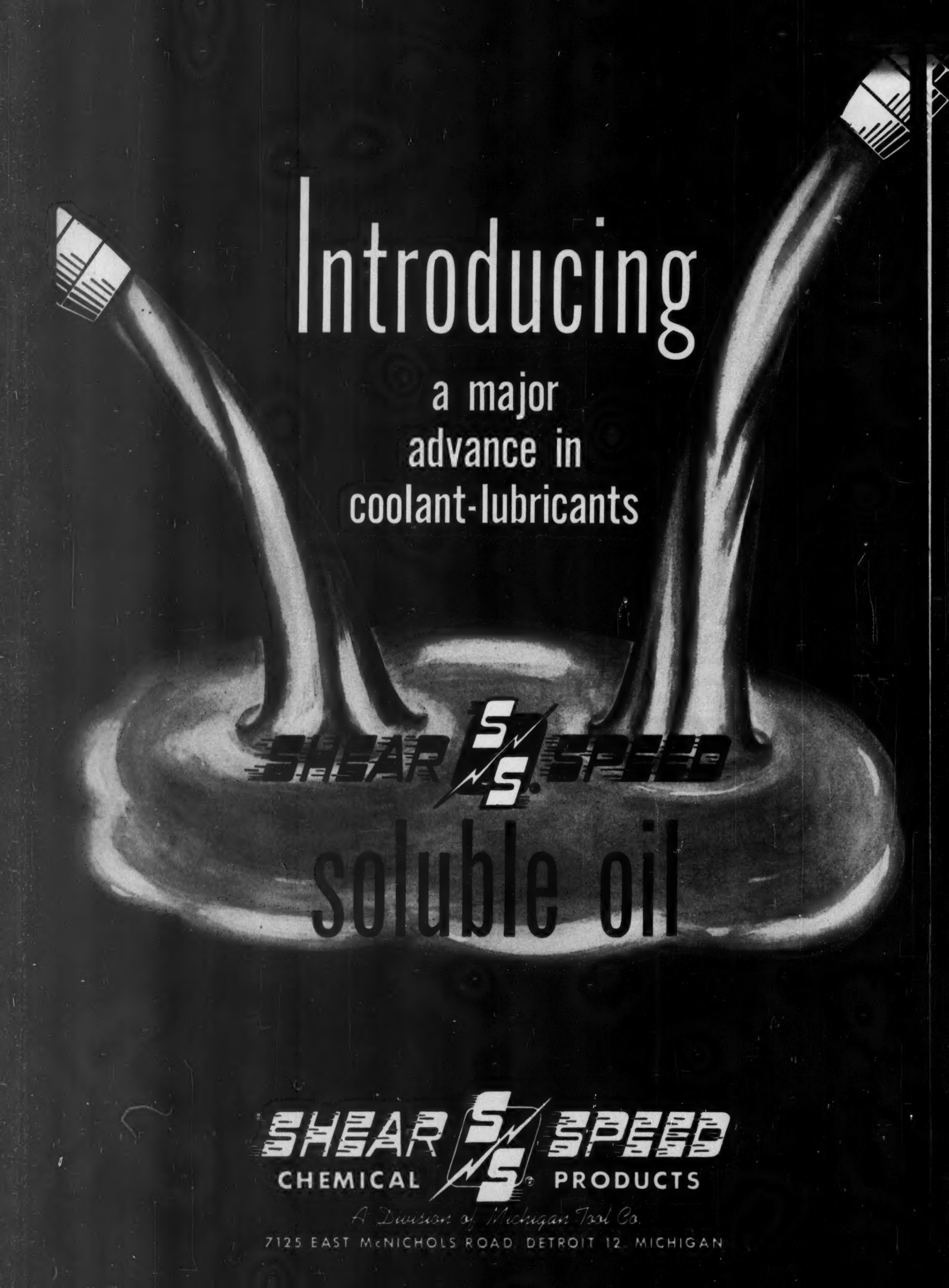
Niagara advanced engineering features and modern streamline styling combine to make these presses leaders in their field.

- Electrically welded steel construction
- Air actuated electrically controlled sleeve and friction clutches
- Anti-friction bearing mounting for high speed shafts, flywheel and clutch wheels
- Gearing enclosed and running in oil
- Neither gearing nor shafting overhang the working area to block light and be a potential danger
- Single and double geared
- Single or double end (twin) drive
- Adjustable air counterbalance for slide
- Pneumatic draw cushions with adjustable pressure and surge tank
- Wide range of sizes and capacities
- J. I. C. features if desired

Write for catalog

Manufacturers of a complete line of sheet metal working equipment ranging from small hand tools up to large power operated machinery.

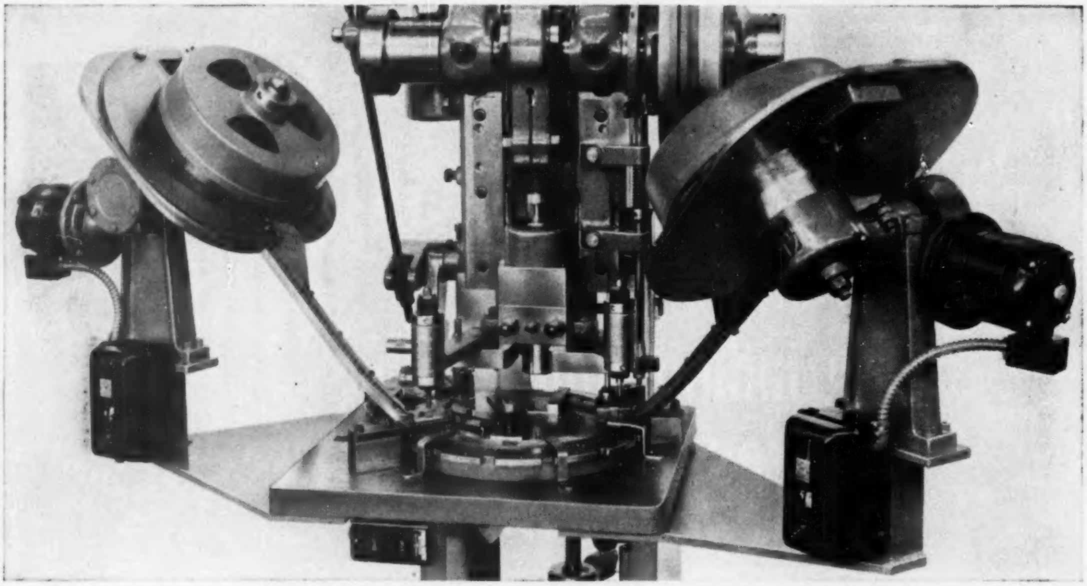
DISTRICT OFFICES: DETROIT • CLEVELAND • NEW YORK


Introducing
a major
advance in
coolant-lubricants
SHEAR S S SPEED
soluble oil
SHEAR S S SPEED
CHEMICAL PRODUCTS
A Division of Michigan Tool Co.
7125 EAST McNICHOLS ROAD, DETROIT 12, MICHIGAN

When you run V & O long slide presses you can inspect an occasional few of your stampings and be sure that the others are exactly like them. And when you can do that, when your machines operate with such consistent precision that random or chance imprecisions are statistically unlikely, then you have quality control.

FOR QUALITY CONTROL

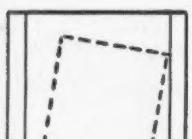
V&O



V & O long slide press that automatically feeds and assembles two parts from their individual hoppers, 128 strokes a minute.

INVITATION TO INGENUITY

V & O long slide design provides space for precision-promoting tooling. Ingenious design can apply moving and stationary members that make random operating imprecisions statistically unlikely.



THE LONG SLIDE PRINCIPLE

eliminates the random imprecisions that can come from stroke misalignments.

The longer the slide the less can be the angular misalignment.

THE V & O PRESS COMPANY

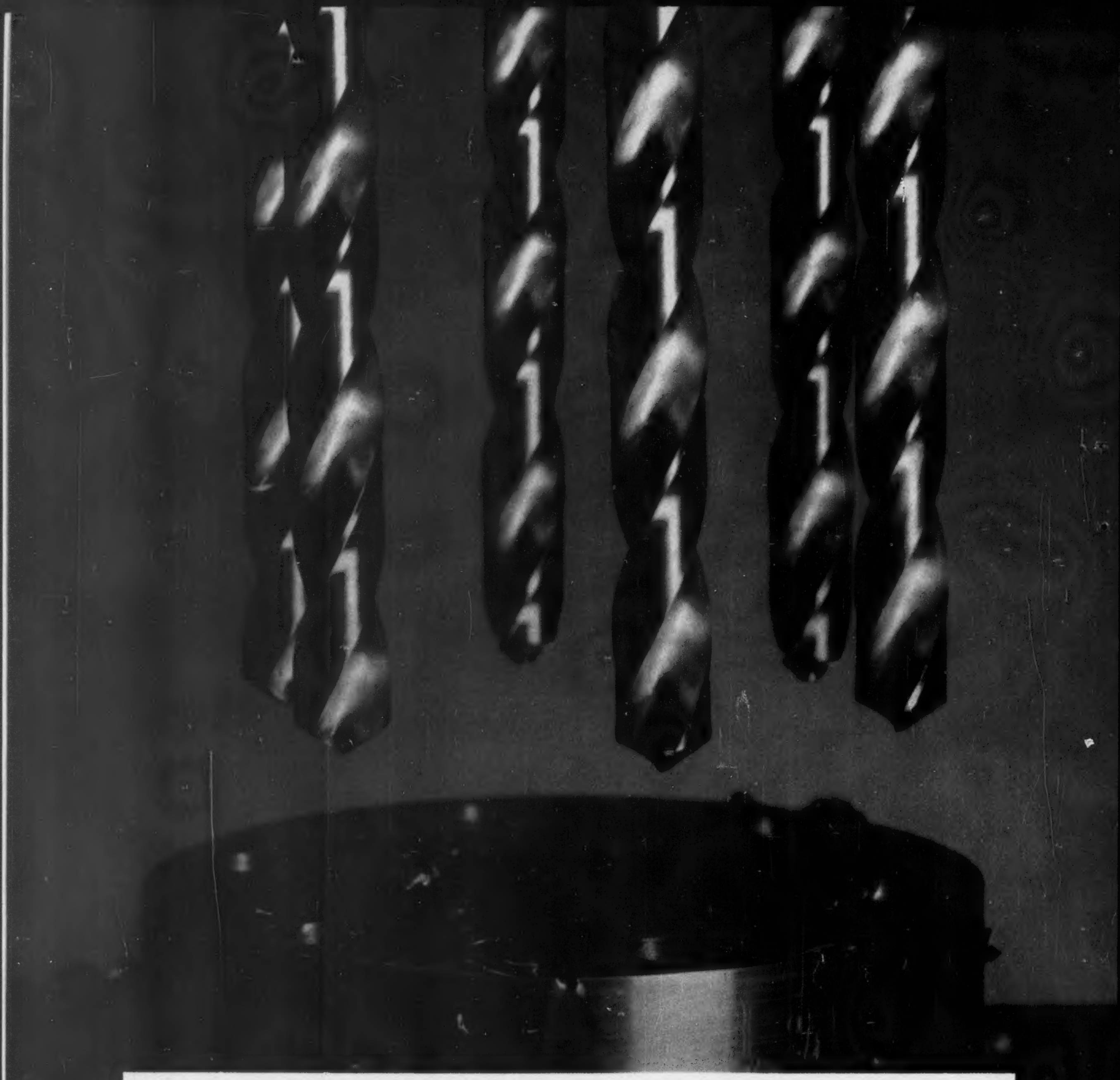
DIVISION OF EMHART MFG. CO.

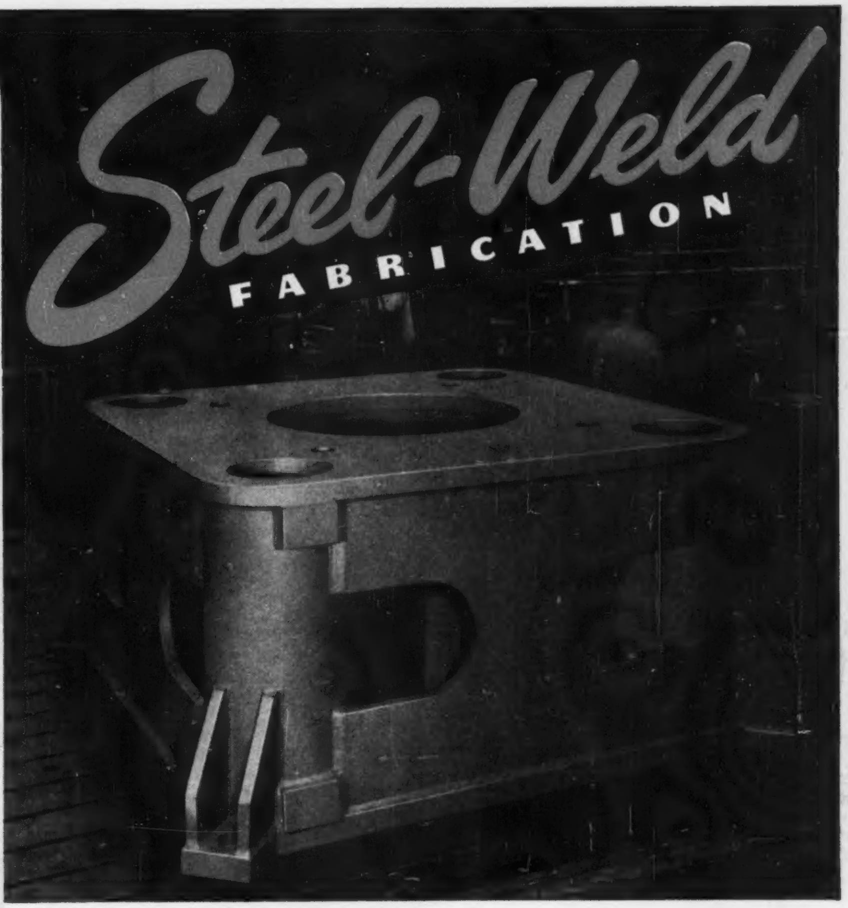
HUDSON NEW YORK

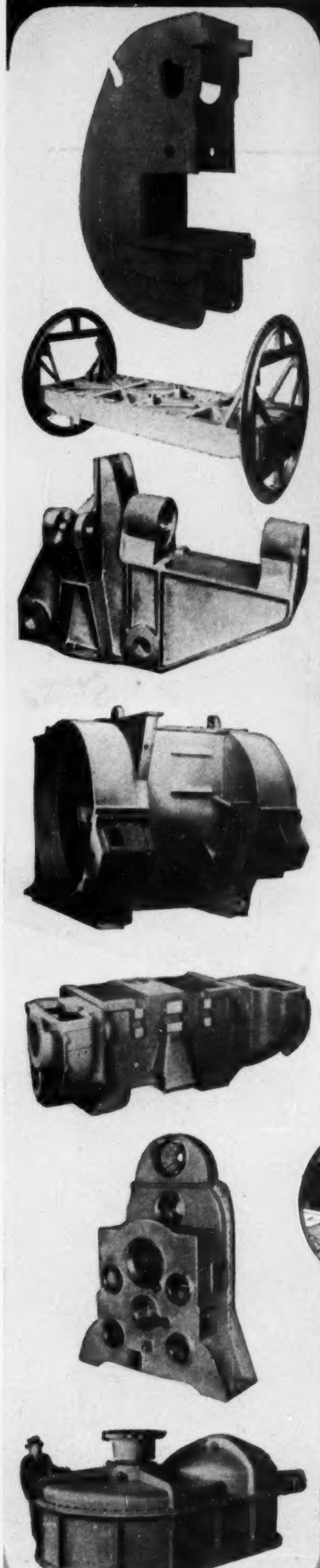
BUILDERS OF PRECISION POWER PRESSES AND FEEDS SINCE 1889

Only the best is good enough


SCENE 41: "Taps that Shoot!"
... an actual scene from the GTD-Greenfield sound film "FACTS ABOUT TAPS AND TAPPING"
VOICE: "This high-production tap is called a Gun tap because it shears the chips and 'shoots' them ahead of the tap ... Designed for tapping in through holes, or blind holes having plenty of space for chip accumulation ... Shallow flutes make Gun taps extra strong ... Used whenever possible to minimize tap breakage."
GREENFIELD
TAP AND DIE CORPORATION
GREENFIELD, MASSACHUSETTS
This 26-minute full-color motion picture "FACTS ABOUT TAPS AND TAPPING" is now available for group showing through your local GTD-Greenfield distributor.







Use WELDED STEEL for Greater Strength with Less Weight!

Illustrated above is a twenty-two ton Moving Cross-Head for a 2500 ton Press. This and other units illustrated at the left are typical of thousands of Steel-Weld Fabricated parts and assemblies produced and machined by Mahon for hundreds of manufacturers of heavy machines and equipment. If parts of your product could be redesigned and produced to better advantage through Steel-Weld Fabrication, or, if you require a limited number of large heavy pieces, in which pattern costs are a consideration, you can turn to Mahon with complete confidence . . . personnel and facilities are available within the Mahon plant to do the complete job from drawing board to finished machining. You will find in the Mahon organization a unique source with complete ultramodern fabricating, machining and handling facilities to cope with any type of work regardless of size or weight . . . a source where skillful designing and advanced fabricating technique are supplemented by craftsmanship which assures a smoother, finer appearing job embodying every advantage of Steel-Weld Fabrication. See Mahon's Insert in Sweet's Product Design File, or write for further information.

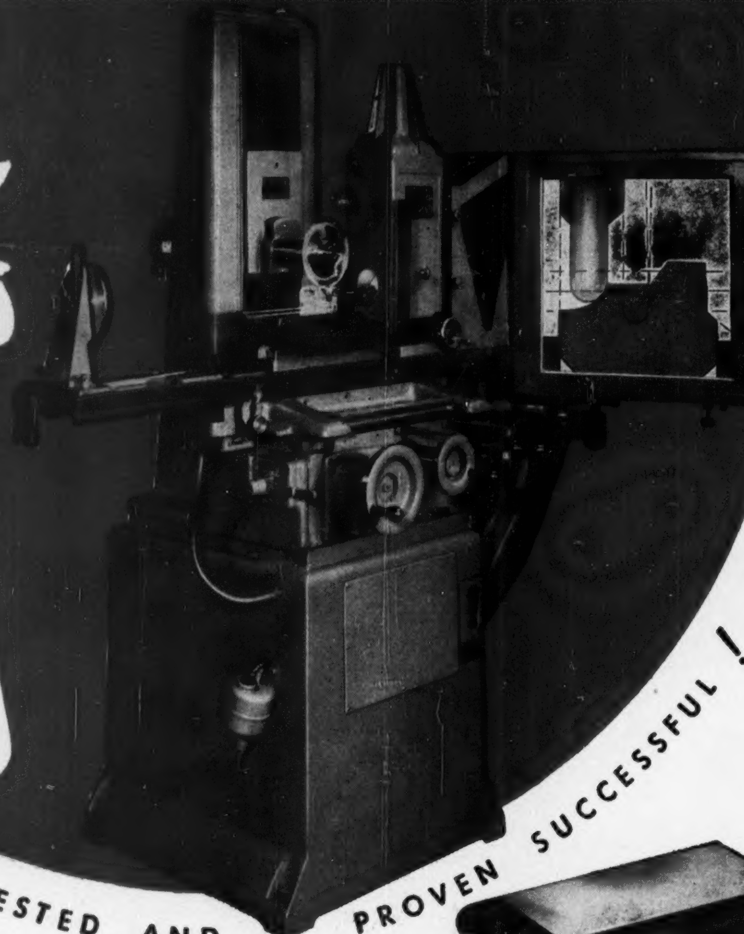
THE R. C. MAHON COMPANY
DETROIT 34, MICHIGAN

Engineers and Fabricators of Steel in Any Form for Any Purpose

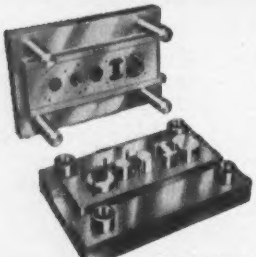
MAHON

Positive Results with VISUAL GRIND

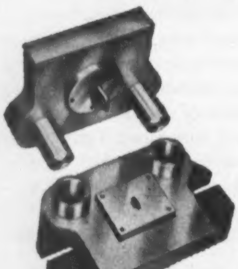
TRADE MARK



TESTED AND PROVEN SUCCESSFUL!



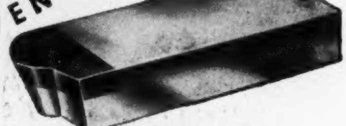
Progressive Die



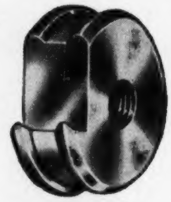
Blanking Die

Here is precision contour grinding at its best. Steel and tungsten carbide form tools, die sections, templates and related items are efficiently processed in dependable, economical fashion. Our basic magnetic chuck work-holder affords positive positioning yet with flexibility for cam, circular and index grinding with the proper fixtures. Work-piece quality is controlled visually at all stages, either while using pre-dressed grinding wheels or when generating the required contour by means of successive, controlled movements. Durable construction around precision optics insures rigidity and long life.

Ask for Bulletin "M-8"



Flat Form Tool



Circular Form Tool

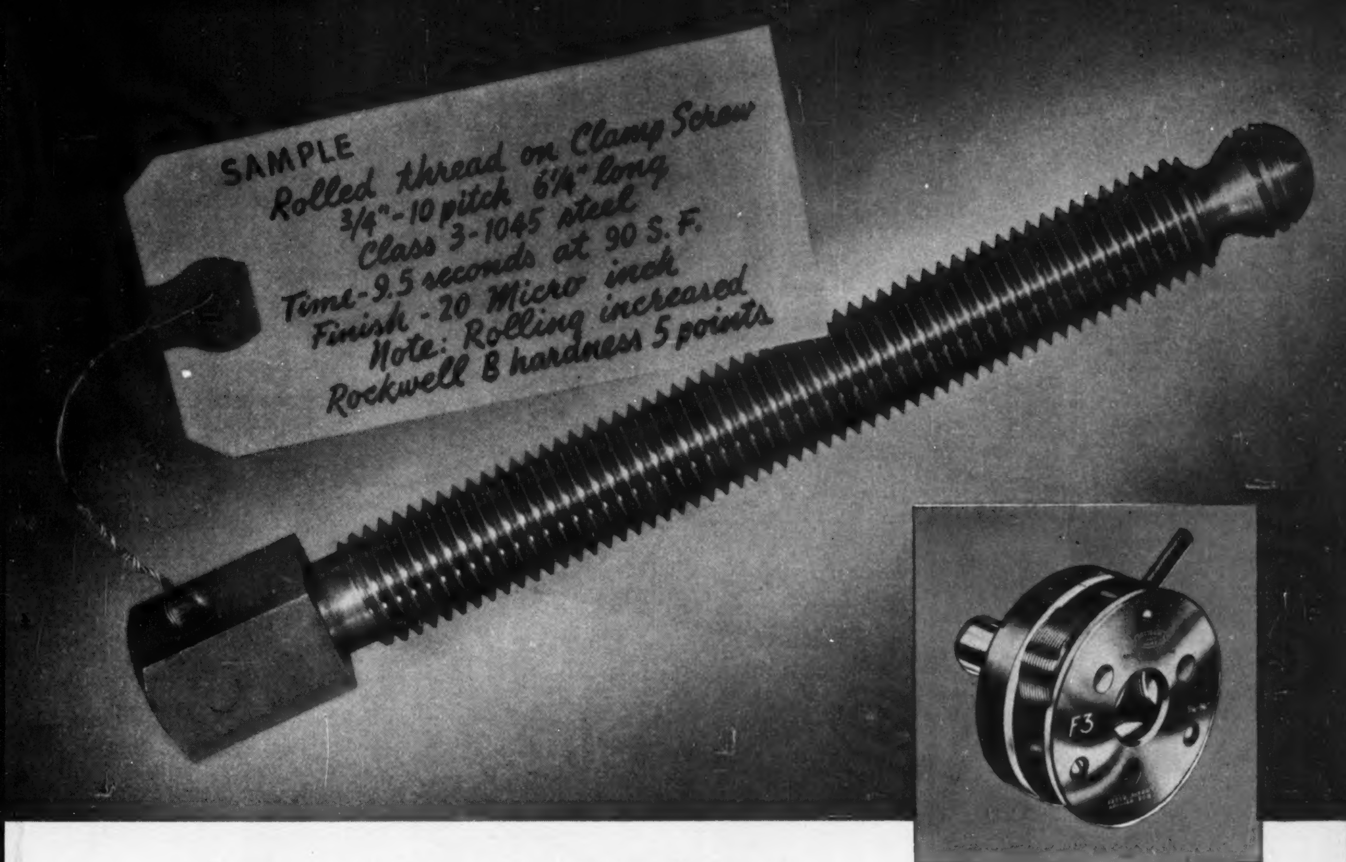
Dovetail Tool

VISUAL GRIND

THE CLEVELAND GRINDING MACHINE COMPANY

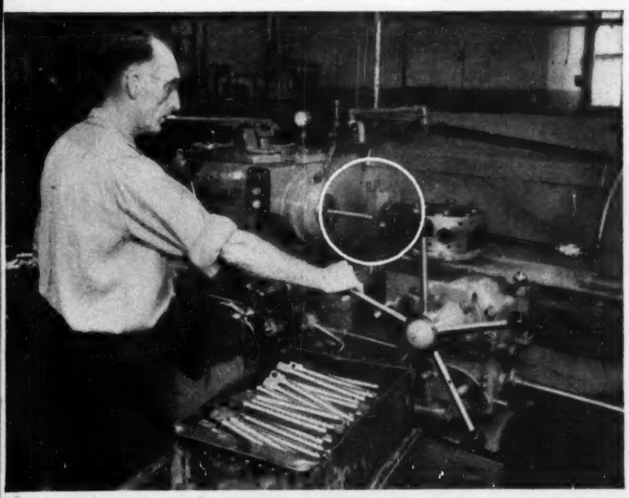
1643 EDDY ROAD • CLEVELAND 12, OHIO

New Possibilities in Optical Grinding



WHY THIS NEW SELF-OPENING HEAD

Rolls threads more accurately · stronger · smoother... and cheaper than any other tool



¾" Self-Opening head rolling piece shown on a hand operated turret lathe.

This "Fette" patent chipless thread forming method is *different*—material rolled flows in an axial direction so that the thread is generated ahead of the rolls. Flow to full depth of thread avoids broken grain structure and cratering crest; surfaces are densified, smoother, more wear resistant. Part shown is unretouched.

It works like this—annular grooved rolls are positioned in plates in the head and only the rolls are changed for different thread forms or pitches. Fine adjustment is provided for exacting diameters. Rolling speeds are equivalent to turning speeds.

Self-opening heads, with simple quick-acting gear mechanism, frees the work instantly at proper thread length; no lead screw or follow up cam required.

These National Acme (Fette patent) Heads accommodate all standard parallel thread forms and are made in both revolving and non-revolving types suited to horizontal and vertical machines.

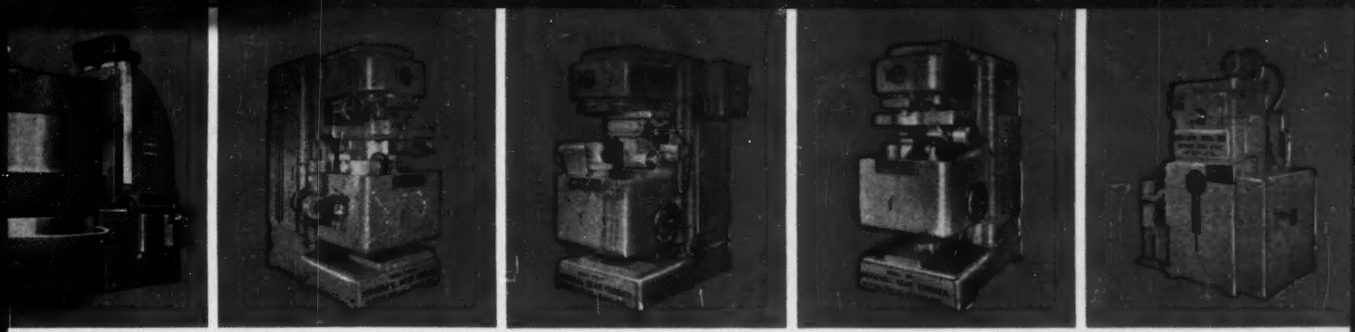
Bulletin FRH-53 gives full data

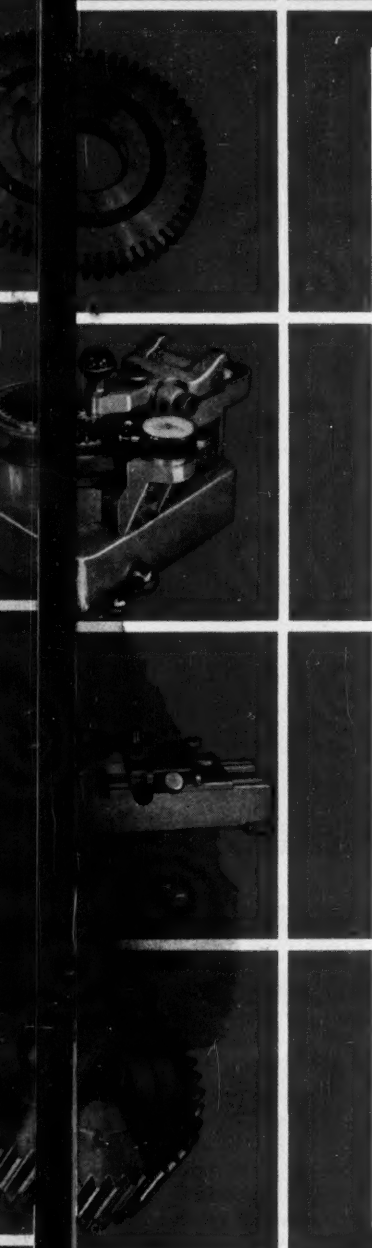
Manufactured and Sold in U. S. A. only by

The NATIONAL ACME COMPANY

170 East 131st Street • Cleveland 8, Ohio, U.S.A.


Hobbing
Transmission Gears
350% Faster
1458 Ultra Speed Gear Hobber
GEAR CUTTING
GEAR FINISHING
Complete Equipment
For Gear Production
GEAR LAPPING
GEAR CHECKING





.....headline in Production Engineering & Management January, 1953

"FORD Hobs Gears 350% Faster"

We've checked on it and the editors of PRODUCTION ENGINEERING & MANAGEMENT are right. At Ford Motor Company 3⅛" diameter, 9-pitch, 1⅝" face width transmission gears are being hobbed at a production rate 350% greater per spindle than compared with multiple spindle machines. To do this Ford uses one of the new Michigan Ultra-Speed gear hobbers equipped with double thread accurate unground Michigan hobs. Gears are hobbed two at a time, 58 seconds per pair.

Despite the high output rate, 225 gears are produced per sharpening of the hob. Among the reasons given are that "the machine is of rugged, compact construction, simplified in design, with few gears for the index and main drive and . . . with a maximum spindle speed of 1000 rpm."

Of interest is that better control of surface finish is obtained by easier subsequent shaving. Loading and unloading time is kept to a minimum by hydraulically-actuated expanding arbors. Vibration has been practically eliminated by providing maximum rigidity plus a flywheel to dampen torsional vibration.

For further details, write for Bulletin #1458-52.

GEAR PRODUCTION HEADQUARTERS

MICHIGAN TOOL CO.

Michigan Tool Company

COMPLETE from blank to finished gear EQUIPMENT

7171 E. McNICHOLS RD. • DETROIT 12, MICHIGAN, U. S. A.


CHANGE FROM RIGHT OR
LEFT HAND TURNING IN
10 SECONDS


BALANCED PERFORMANCE

SPECIAL *Chill* CAST BRONZE GEARS

HARDENED AND GROUND STEEL WORMS

Advantages of Philadelphia Worm Gear Reducers

To insure long, dependable service from Philadelphia Worm Reducers, the greatest care and research goes into the selection of materials for the worms and worm gears. The predominant sliding action dictates the use of dissimilar metals to minimize frictional wear.

Philadelphia Worms are of alloy steel with hardened threads. Shaft and threads are smoothly ground and polished after hardening. The result is increased gear life through improved surface finish.

Worm Gears are of high quality chill cast nickel bronze to provide greatest strength, with a low coefficient of friction against the worm.

These and other features of Philadelphia Worm Gear Reducers are explained in detail in our Catalog WG 51 . . . send for a copy.

Philadelphia Gear Works, INC.

ERIE AVE. AND G ST., PHILADELPHIA 34, PA.

NEW YORK · PITTSBURGH · CHICAGO · HOUSTON · LYNCHBURG, VA.

Industrial Gears and Speed Reducers
LimiTorque Valve Controls

BAKER

Standard HEAVY-DUTY DRILLS

2 to 4 WEEKS DELIVERY . . .

ON THESE MACHINES—Subject to prior sale

Standard Baker No. 150 Geared Feed Machine

Standard Baker No. 217 Geared Feed Machine

Standard Baker No. 422 Geared Feed Machine

Standard Baker No. 321 Geared Feed Machine

MAJOR SPECIFICATIONS—Single Purpose Types

	150	150 Q.C.†	217	321	422
1. Capacity—Max. Dia. Drill in S.A.E. 1035 Steel	1½	1½"	2	3	4½
2. Max. H. P. Motor used	7½	7½"	10	15	20
3. Distance center of Spindle to Frame [Gap]*	11"	11"	12¼"	12¼"	12¼"
4. Maximum Spindle Travel	11"	11"	12"	16"	16"
5. Spindle—Outside Dia. splined driving end	1¾"	1¾"	2"	2-13/16"	3¼"
6. Dia. of Spindle Sleeve	2¾"	2.750"	3¼"	4¼"	5¼"
7. Dia. of Spindle Nose	2.975	2.975"	.3225	4.225"	5.225
8. Morse Taper in Spindle as standard	No. 4	No. 4	No. 5	No. 5	No. 6
9. Standard Speed Range in R.P.M.	151-632	48-1120	76-614	27-220	20-165

* Can be increased 3" by use of offset Spacer Block. † Quick Change, 12 Speeds

Baker single purpose type drills are heavy duty . . . provide a wide range of speeds and feeds for Single and Multiple Spindle Drilling . . . Reaming . . . Boring . . . Facing . . . Chamfering . . . Undercutting and Tapping Operations. Write for full details.

Baker Brothers, Inc.
Toledo, Ohio

Gentlemen:

Please send more information on Baker Standard Drills to:

NAME..............................

COMPANY..............................

STREET..............................

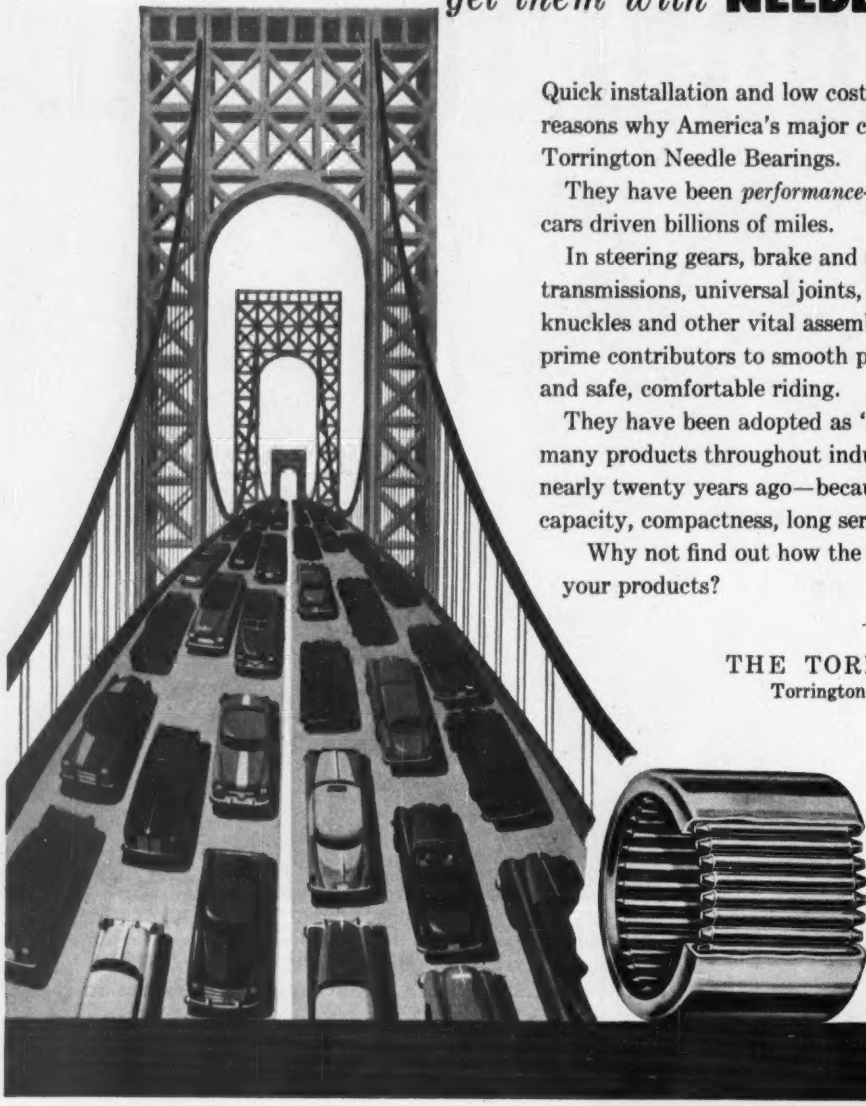
CITY......................STATE.........

BAKER BROTHERS, INC. Toledo, Ohio

DRILLING...TAPPING...KEYSEATING and CONTOUR GRINDING MACHINES

Are Easy Assembly and Low Cost "Musts" for You?

Here's how leading automobile manufacturers get them with **NEEDLE BEARINGS**



Quick installation and low cost are just two of many reasons why America's major car manufacturers use Torrington Needle Bearings.

They have been *performance-proved*, too, in millions of cars driven billions of miles.

In steering gears, brake and clutch linkage pivots, transmissions, universal joints, steering idlers, steering knuckles and other vital assemblies, Needle Bearings are prime contributors to smooth performance, easy handling, and safe, comfortable riding.

They have been adopted as "standard equipment" in many products throughout industry since their introduction nearly twenty years ago—because of their high radial capacity, compactness, long service life and low cost.

Why not find out how the Needle Bearing can improve your products?

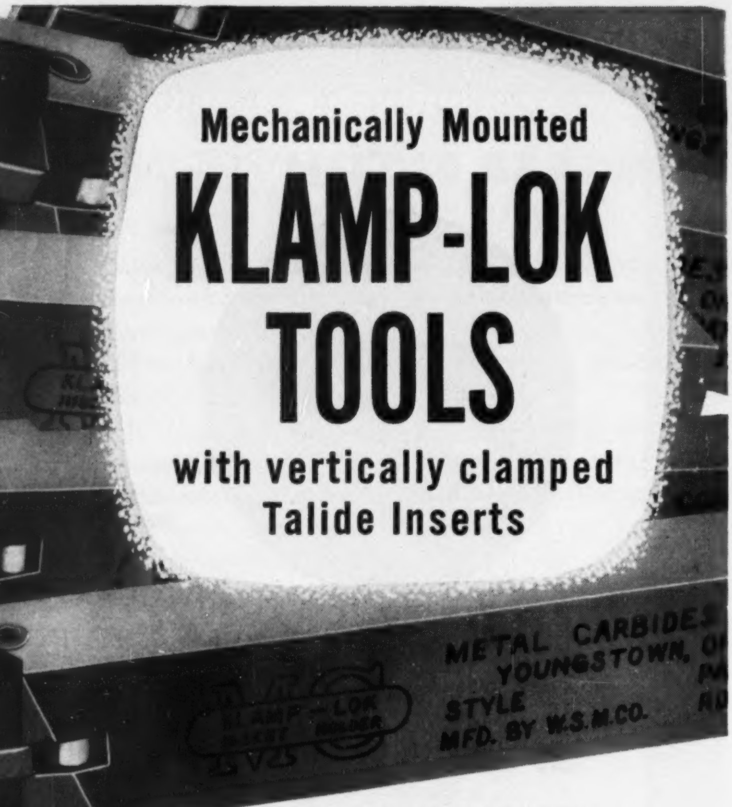
THE TORRINGTON COMPANY
Torrington, Conn. South Bend 21, Ind.

TORRINGTON *NEEDLE* BEARINGS

Needle • Spherical Roller • Tapered Roller • Cylindrical Roller • Ball • Needle Rollers

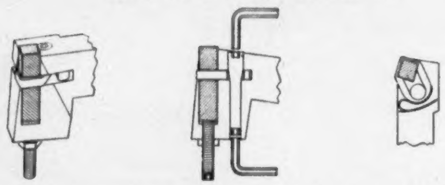
Trade Marks of 12 of the 18 passenger car manufacturers, all of whose cars enjoy the benefits of Needle Bearings.

STUDEBAKER
CHRYSLER
Packard
DeSoto
WILLYS
Nash
KAISER
LINCOLN
Ford
MERCURY



Mechanically Mounted
KLAMP-LOK TOOLS
with vertically clamped Talide Inserts

SPECIAL ADVANTAGES



MAXIMUM SUPPORT given insert by clamping in direction of cutting force—**OPEN FACING** of insert prevents chip erosion of toolholder

QUICK ADJUSTMENT from either top or bottom gives flexibility in clamping, removing or adjusting insert.

TRIGGER ACTION spring clamp assures fast, easy insert removal — and trouble-free servicing of toolholder.

● KLAMP-LOK tools are rugged, rigid and extra strong—and are proving their superiority in hundreds of plants all over the country.

Multiple-sided cutting edges of the TALIDE insert, turned end for end, give exceptionally long service life between grinds—and can be reground without removing toolholder from the machine setup. Equally adaptable for either conventional or inverted type of mounting, the KLAMP-LOK toolholder cuts costs on all types of tough, high-speed production jobs.

Solid TALIDE inserts are stocked in 9 standard sizes and 4 standard grades. KLAMP-LOK toolholders are available in 10 standard styles and 70 standard sizes.

Write or wire today for circular No. KL-52, or ask your nearest TALIDE service engineer for a personal demonstration. Metal Carbides Corporation, Youngstown 7, Ohio.

HOW TO ORDER

You can order direct (24-hour service) from warehouses in Newark, Youngstown, Detroit or Chicago. Place order, too, for Talide Tools and Tips.

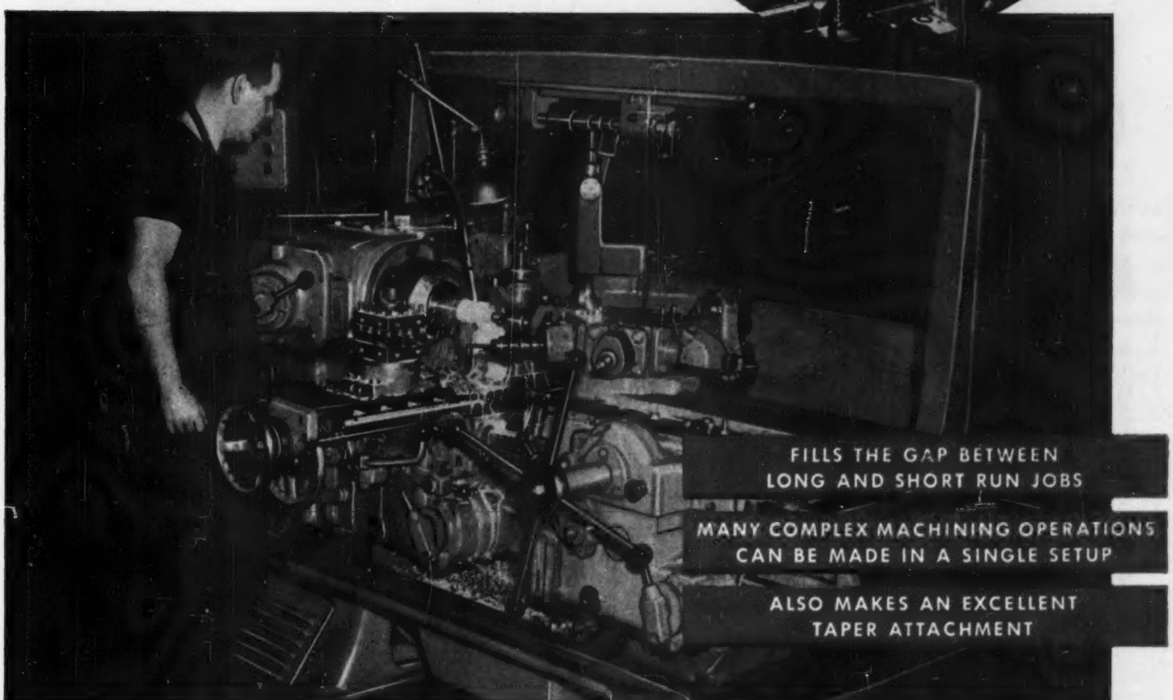
METAL CARBIDES CORPORATION
MC
TALIDE
YOUNGSTOWN 7, OHIO

SINTERED CARBIDES · HOT PRESSED CARBIDES
TUNGSTEN ALLOY HEAVY-METAL
OVER 25 YEARS' EXPERIENCE IN TUNGSTEN CARBIDE METALLURGY

NEW HYDRAULIC TRACING ATTACHMENT

for J&L turret lathes*

Will reduce your costs —direct and indirect—by combining in a single machine all the advantages of TRACING for contour turning, boring or facing operations, with the advantages of multiple tooling and the many other time saving, cost saving features of J & L Universal Turret Lathes.



*RAM TYPE or No. 7 SADDLE TYPE

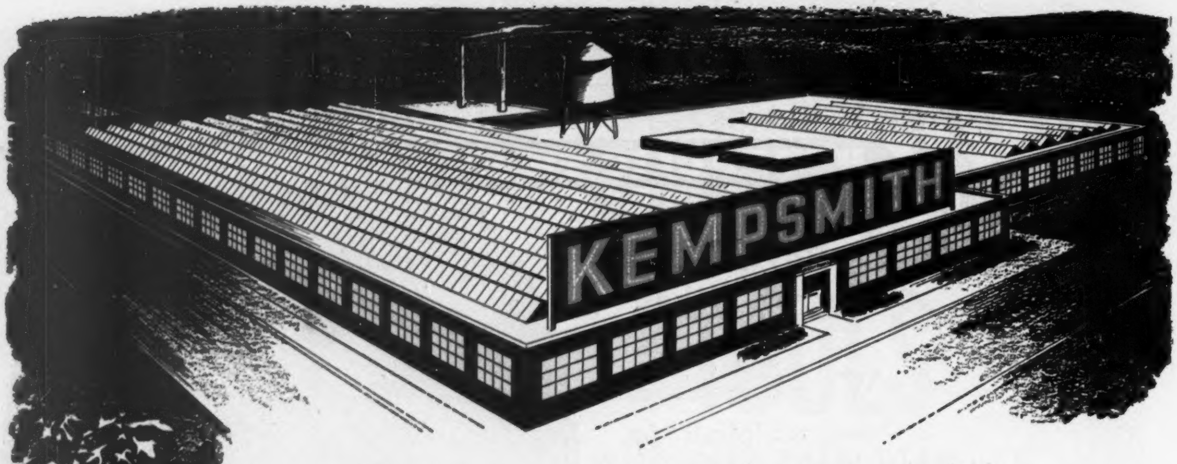
P.S. → This attachment can be purchased with new machines or installed in the field on machines now in service. Write for descriptive leaflet giving complete specifications.

JONES & LAMSON

Machine Tool Craftsmen Since 1835

J&L

JONES & LAMSON MACHINE CO., 512 Clinton St., Dept. 710, Springfield, Vt., U.S.A. . **TURRET LATHE DIV.**

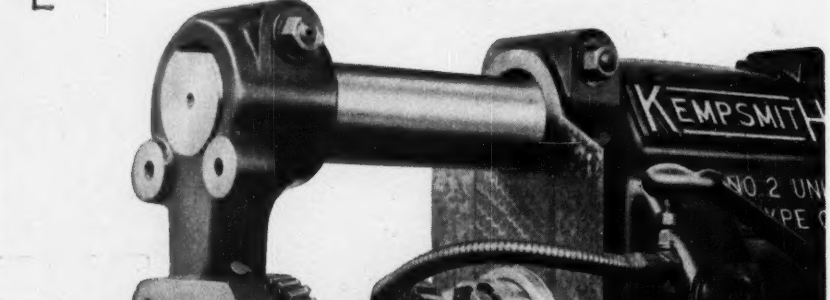


A Leadership Backed by More than 64 Years of Milling Machine History

Back in 1888, Kempsmith Engineers developed and produced the first Kempsmith Miller — a machine that was destined to achieve world-wide fame. The successful performance of this early model encouraged important engineering improvements and refinements resulting in much greater speed and precision in milling operations. Today, Kempsmith continues as a leader in the industry. The ruggedness, precision and ability to take heavy cuts smoothly make Kempsmith Milling Machines ideal for production, toolroom or general purpose milling. If you have a milling problem, consult Kempsmith. Our engineers will gladly give you the benefit of their broad experience in this specialized field.

THE KEMPSMITH MACHINE CO.
Milwaukee 14, Wisconsin, U.S.A.

Kempsmith Type "G" Plain Miller. All geared for positive power and smooth cutting, free from chatter. Note rugged, streamlined appearance. All controls are grouped within easy reach of the operator. Available in No. 1, 2 and 3 sizes, plain and universal models.



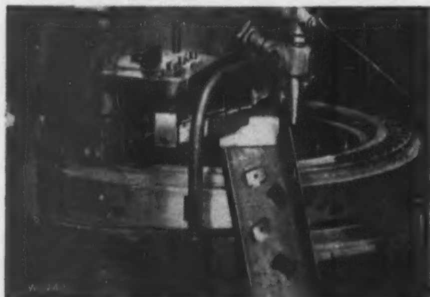
Let the chips fly— Kempsmith Millers have what it takes for rough production battles—built-in ruggedness, increased range of speeds and feeds, greater power. Every machine is precision-built, the product of 64 years of milling machine experience.

KEMPSMITH

• Precision Built Milling Machines Since 1888 •

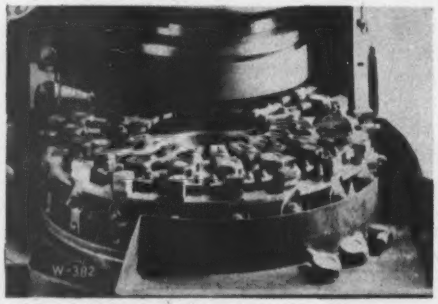
A-7270-1PC

4360 surfaces per hour!



2000 surfaces per hour!

940 surfaces per hour!



900 surfaces per hour!

1400 surfaces per hour!

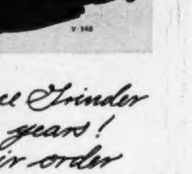
FIELD REPORT:

... a Blanchard No. 16-A Surface Grinder saved them \$39,000 in 2½ years! (cost approx. \$12,500) Their order follows for a Blanchard No. 16-A2!

Here's proof of performance and proof of satisfaction, yet typical of what users expect *and get* from the Blanchard 16-A Surface Grinder. Several typical examples of production rates are shown here. Above, for instance, .003" of stock is being removed from one side of small gears to a tolerance of ±.001" *at a rate of 2100 per hour!* This machine has a 30" chuck and a Blanchard Demagnetizer.

The No. 16-A grinds continuously with a wheel that is set and automatically maintained at a fixed height above chuck face, and finishes one surface of the work to size in one pass under wheel. Operator has only to load the work on the magnetic chuck or in an automatic clamping fixture. A wheel control automatically feeds the head down to compensate for wheel wear. Unloading is usually automatic. Attachments can be supplied for demagnetizing and washing the work as it leaves the grinder. On most work, limits of ±.0005" are readily maintained.

The No. 16-A2 (not shown) has two wheels, each with automatic size control. It roughs and finishes one surface of the work in one pass through the machine.



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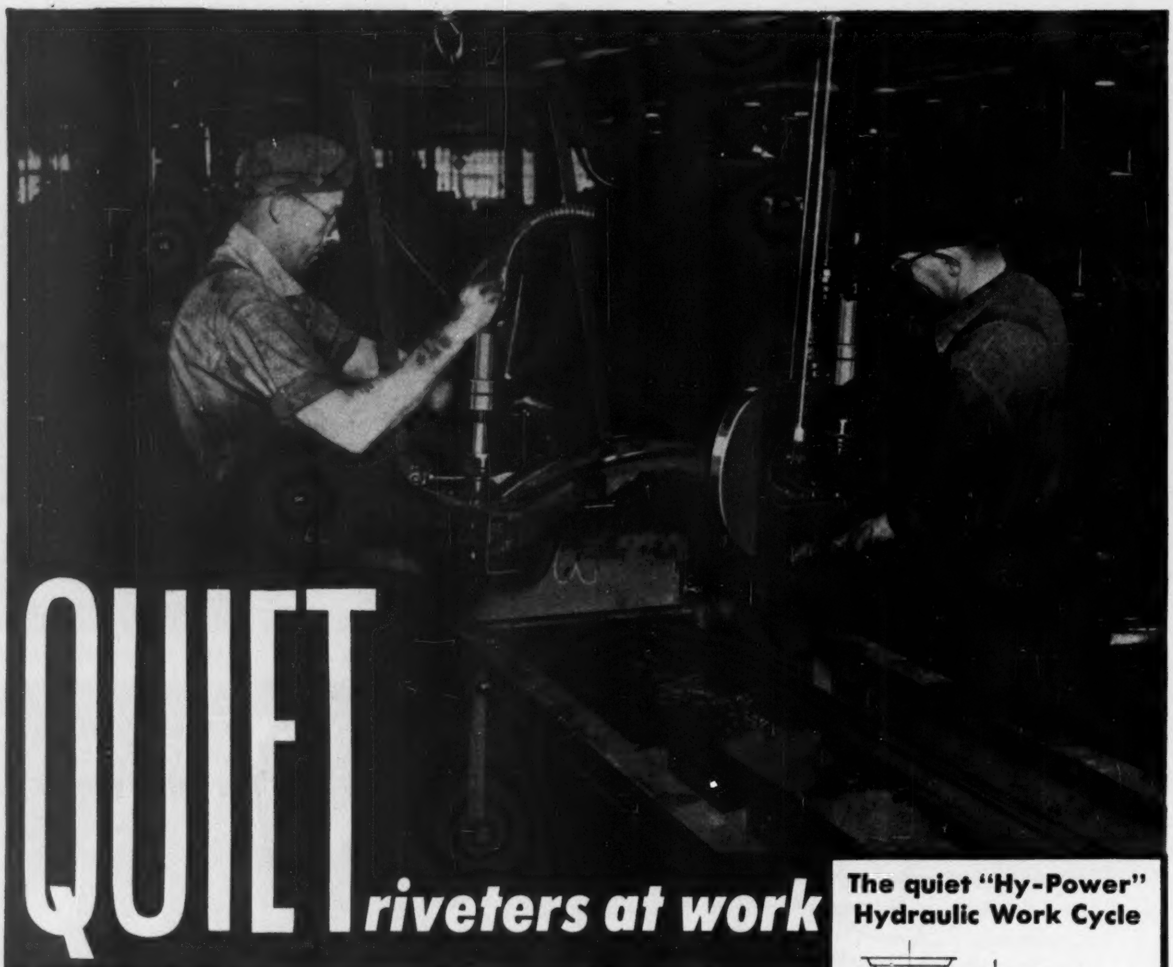

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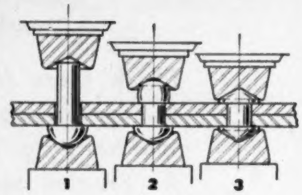

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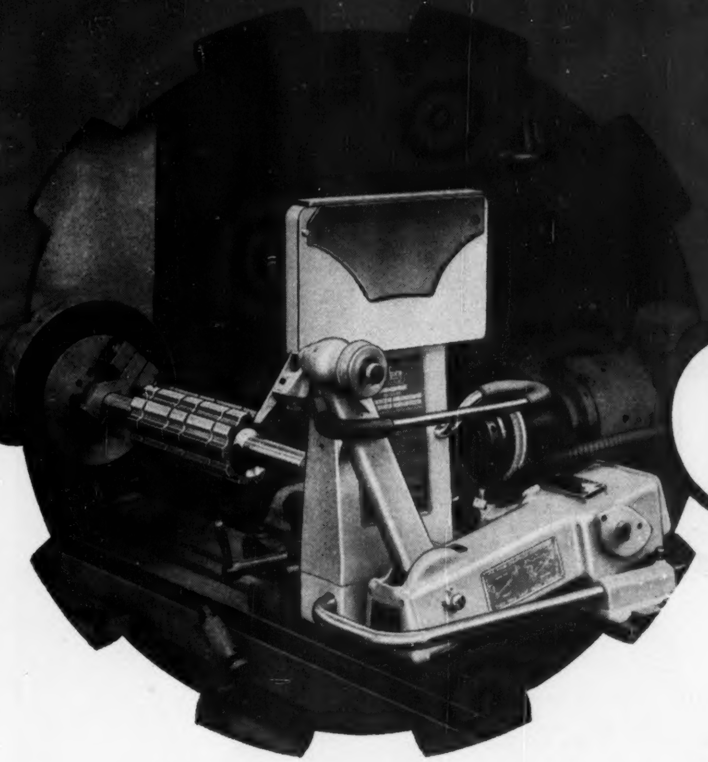

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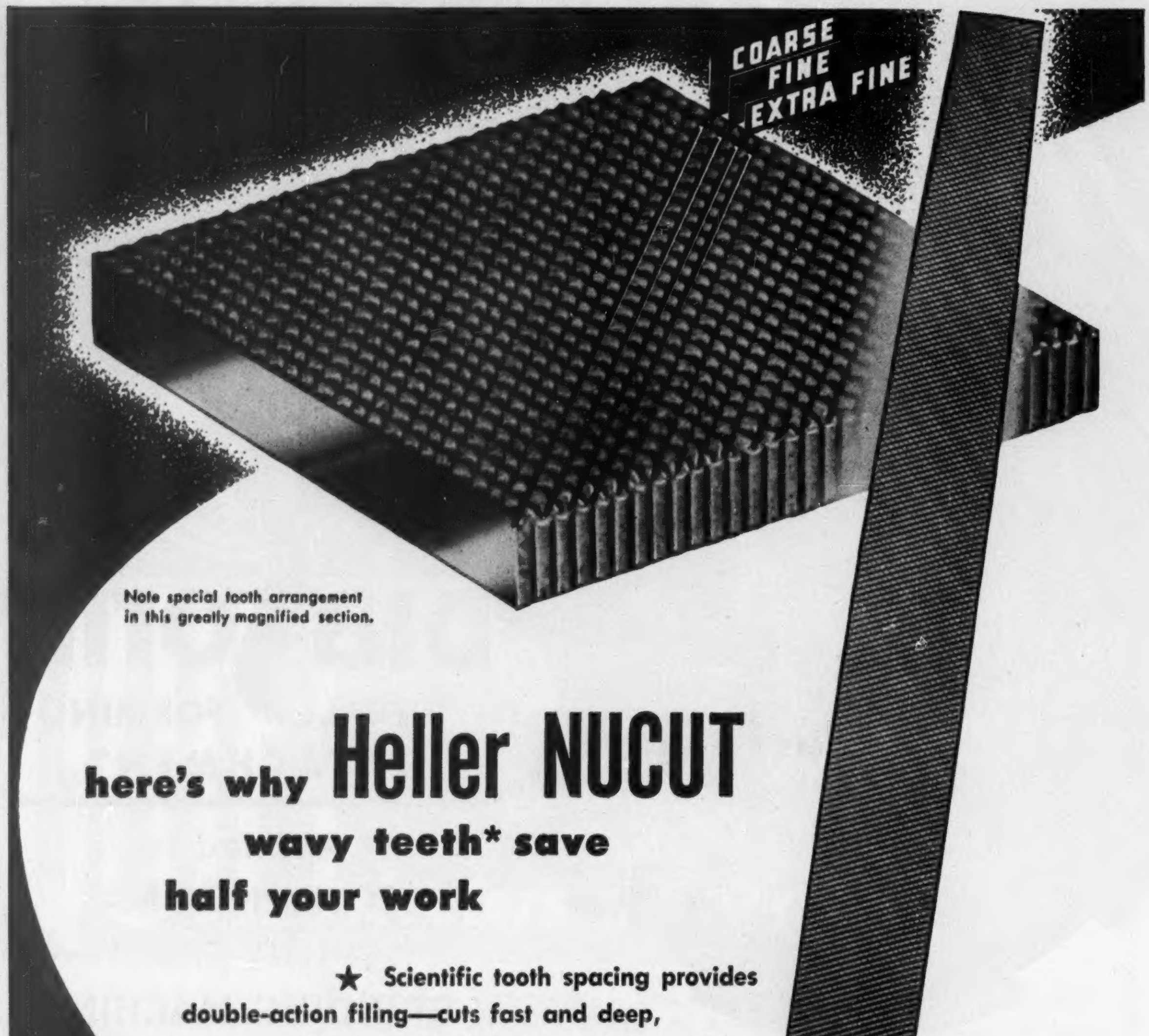
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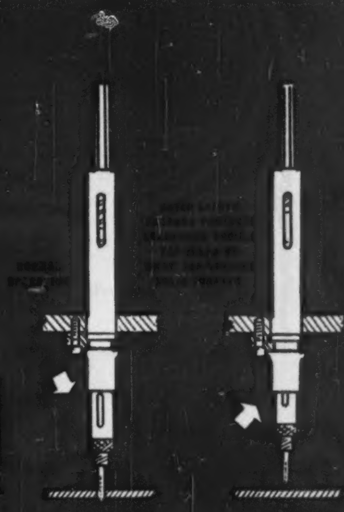

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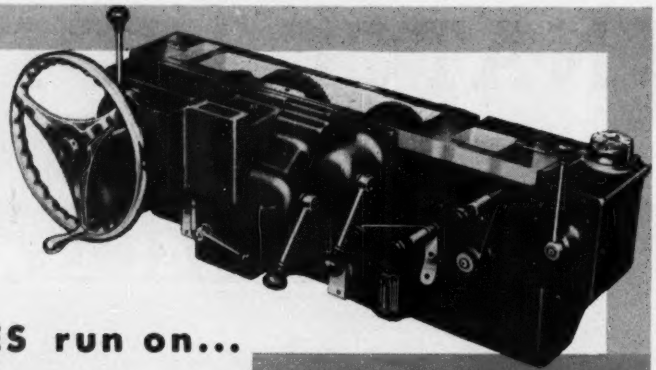

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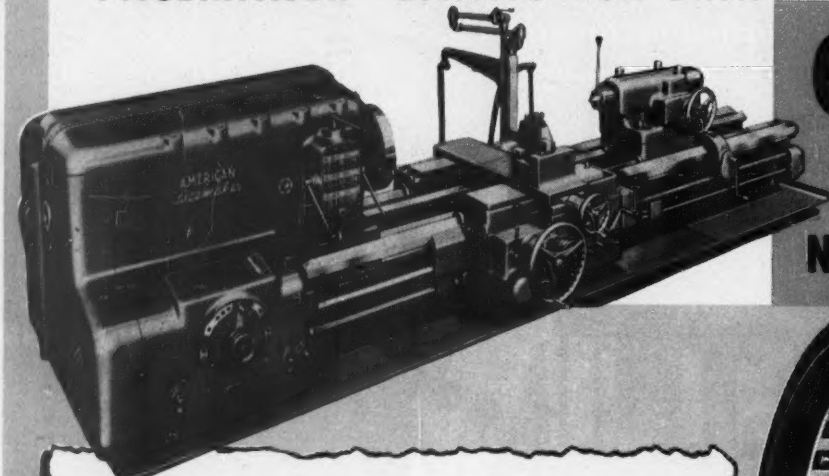

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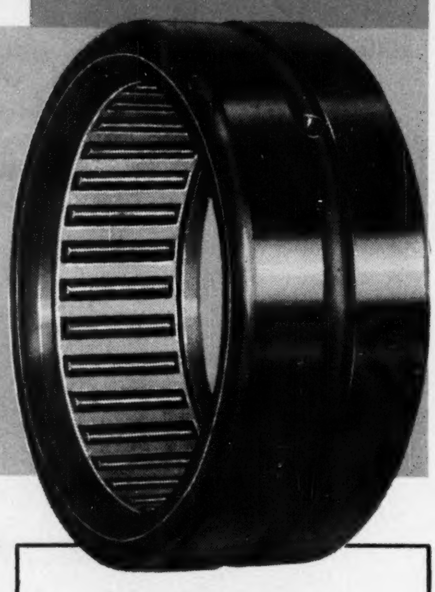

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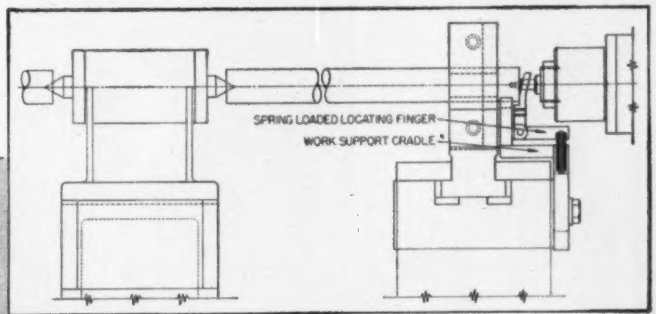

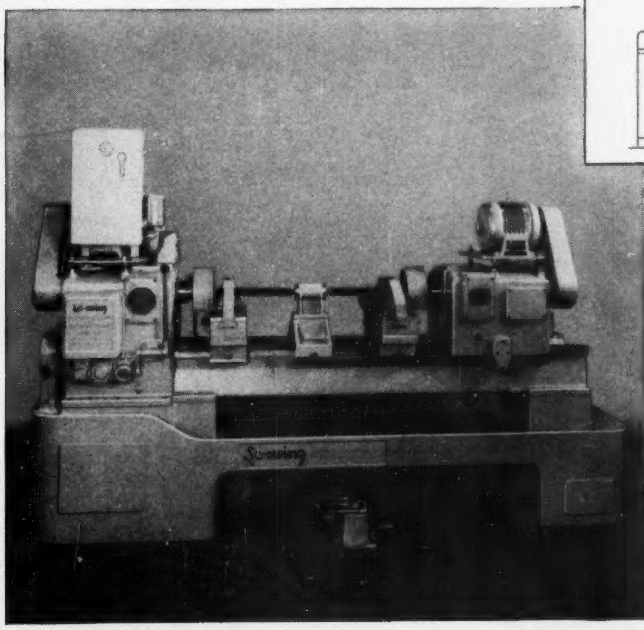

MODEL "CS" Lo-swing CENTERING MACHINE CUTS COSTS BY CENTERING TWO SHAFTS SIMULTANEOUSLY

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The line illustration shows the detail of the work support and spring loaded locating finger supplied with each vise. The spring loaded locating finger holds the shaft under tension on the double center fixture until the shafts are clamped tightly in the vises.

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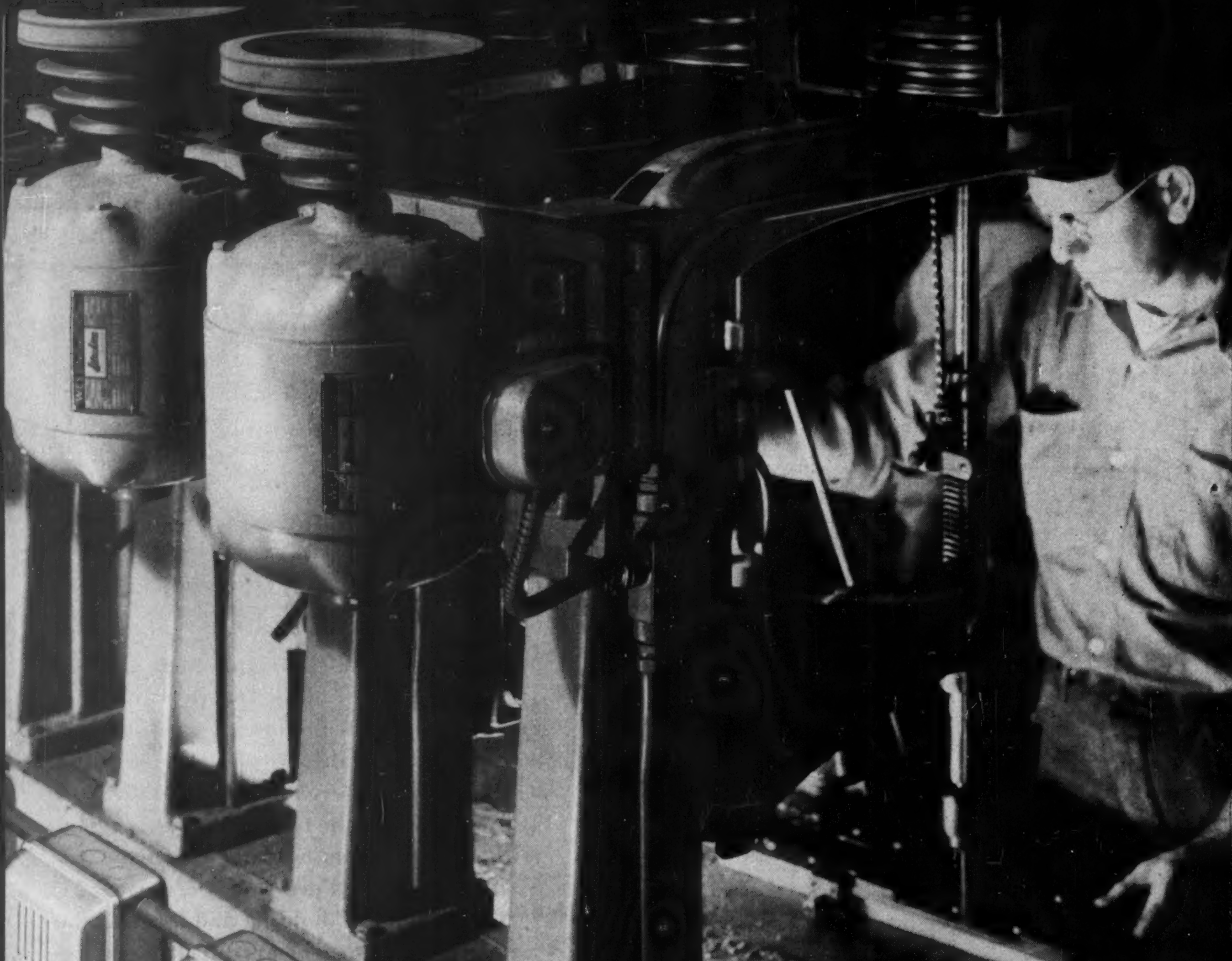
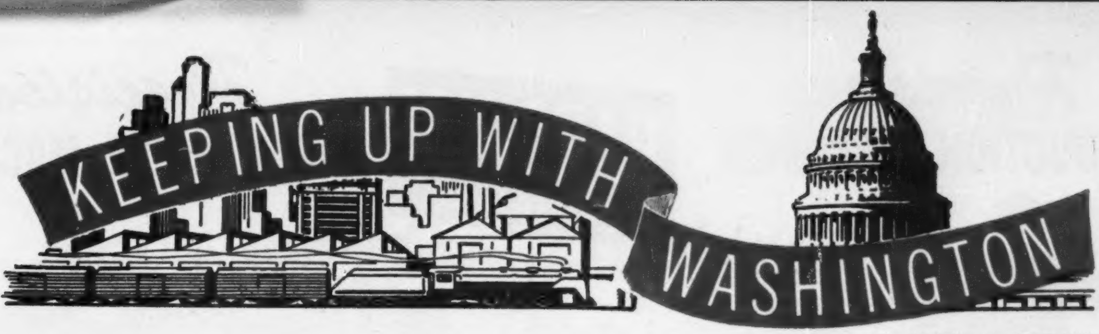




By LORING F. OVERMAN

The Score as the New Fiscal Year Begins

AT the turn of the fiscal year in Washington, all eyes were turned on the deadline races. The Defense Production Act had to be extended. Action on several programs was suspended in mid-air while agencies and staffs watched appropriation measures. The battle of the Excess Profits Tax demonstrated that one man—if he happens to be chairman of the House Ways and Means Committee—can give even the President of the United States some uncomfortable moments.

Capitol Hill veterans felt that Agency people were naive in not making "for-tomorrow" decisions today, despite uncertainty as to whether there would even be such a tomorrow in the life of the agency involved. Observers point out that Congress has become used to making plenty of funds available for everything, at the very last minute if need be, and that there is no reason to postpone action just because the authority to act is momentarily missing.

Organizing the ODM

The new Office of Defense Mobilization (ODM) has been established by the President's Reorganization Plan No. 3. Dr. Arthur S. Flemming has been confirmed by the Senate as Director, and at the end of the fiscal year he was looking for a deputy director and others to head the ODM Divisions—Production Requirements and Programs, Materials, and Stabilization.

QUESTIONS that must be decided promptly include these:

1. Tax amortization—A review of the policy as it will be affected by whatever new production goals are decided upon for the coming year.
2. Machine tool inventory—Control was in the hands of NPA (National Production Authority). The uncertainty surrounding that agency at the turn of the fiscal year is clouding the issue. One thing was certain—Dr. Flemming has been asked by the President to determine the rules for the future handling of government-owned production equipment.
3. Stockpiling policy—The level for the third quarter has been fixed and the necessary directives issued. Dr. Flemming and his ODM must still decide what to do about tin and the increasingly short ferrous alloys.
4. Controlled materials for military and related programs—Decisions must be made.
5. Mobilization base—A revised base was under consideration, dictated by changes in Korea and elsewhere.
6. Metals consumption—The ODM was to work out a method of reporting consumption patterns. The purpose is to keep a record of the amounts of metals required by various users, so that allocations can be made equitably and accurately in the event another major defense effort should develop.

Machine Tool Inventory

Neither government nor industry advisors assigned as business guides have been able to work out a satisfactory solution to the problem of how to handle some 500,000 machine tools having an inventory value of about $6,000,000,000. Director Flemming has been instructed to solve the problem by (1) avoiding, insofar as possible, disposal of machine tools in such a way as to flood the market and damage the machine tool industry; (2) storing and maintaining general-purpose tools in readiness for instant use by defense contractors; and (3) disposing of obsolete tools without disrupting the market.

The Office of Defense Mobilization is said to be calling for a review of all special-purpose tool contracts, with a view to canceling those for which no useful purpose can be found. The idea is that even if termination costs are high, canceling the contracts would be less costly than paying for completion, maintenance, and disposal of such tools.

GENERAL-PURPOSE tools that may not be needed when the defense program levels out will not be measured by the same yardstick. ODM holds the view that such tools can always be used, and the state of completion would have an important bearing on whether the contract would be completed. Another step in the expected leveling-out process would limit purchase authority to $1,400,000,000—the exact amount of tool orders now placed. The original authority was for $2,100,000,000. Another action increases the amount that the Government can pay for tools ordered under pool contracts, but not picked up by individual contractors.

Heavy Press Program Trimmed

In justifying the reduction of the controversial heavy press program from seventeen to ten presses, Air Force Secretary Harold E. Talbott gave two reasons. The first was that the projected press capacity seemed to exceed current requirements. The second was that so-called elephant-size presses have not previously been operated in this country, and that prudence dictated trying to eliminate any "bugs" before completing the entire program.

Work already done on the seven terminated presses will not be lost. The presses will be transferred to the Air Force industrial reserve, their final disposition dependent upon the success of the authorized ten presses.

As matters now stand, there will be two 35,000-ton and two 50,000-ton presses; three 8000-ton extrusion presses, two 12,000-ton extrusion presses, and one 13,200-ton extrusion press. Two major problems in the press program have been the task of making die-blocks and the market for the presses when and if the United States returns to a normal economy.

Limited Controls Pose Problem

It remains to be seen whether the economy can get along under the new Defense Materials System now operating in place of the Controlled Materials Plan. The DMS plan is supposed to be used only by direct military contractors, or by contractors serving the Atomic Energy Commission. However, the Department of Agriculture reports that it needs immediately galvanized steel sheets to build storage for 50,000,000 bushels of grain. The sheets will be required in August or September.

Whether or not grain storage can be classified as a national defense measure remains to be seen. If pressure gets the steel for bin builders, it will be considered a door-opener for other pressures. If the steel is not provided, it can be expected that pressure will come from the agricultural bloc on the Hill.

Ideas of the Practical Man Can Earn Big Profits

THE man who operates a machine or does manual labor about the shop is often able to conceive an ingenious method of performing his work with less effort or greater efficiency than is possible with the method in use, which was probably established by men higher up on the managerial scale. This is because the man who is actually on the job devotes all his attention to one particular task and, assuming that he is endowed with average intelligence, he should be more capable than anyone else to suggest improvements upon existing methods. His position is analogous to that of the housewife who, it is acknowledged, has been responsible for many of the labor-saving appliances in the home.

There is the problem, however, of drawing out ideas from workers who may be sensitive to the reactions of their immediate superiors. Also, jealousy is sometimes a factor, and the man with the money-saving idea may suspect that his foreman or superintendent would take undeserved credit if it were disclosed to either of them.

Solution of this personnel problem was found years ago by some of the large industrial concerns through the establishment of suggestion systems, and such systems were so completely successful that today they are found in many plants. Suggestion systems generally involve the use of locked boxes located at various points around a plant in which suggestions can be dropped, addressed directly to an important company executive.

Worthwhile suggestions usually draw monetary awards, it being common practice to recompense the suggester an amount based on the savings which will accrue to the company through the adoption of the idea. In addition to the financial recompense, employes are appreciative of the honor customarily accorded them in company publicity. Incentives for suggestions have proved a most effective inducement, as indicated by the great flood of useful ideas taken from suggestion boxes down through the years.

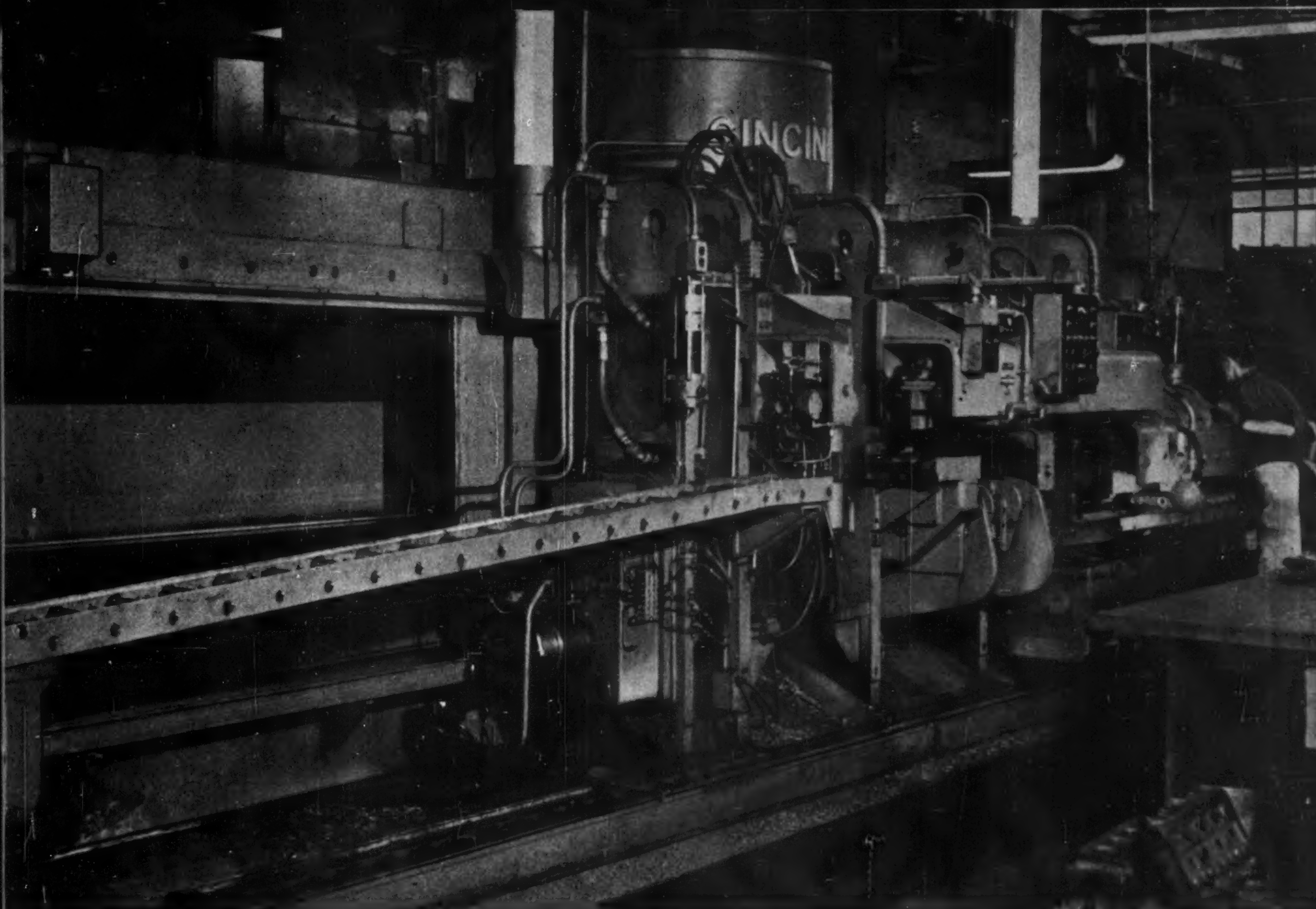
Many millions of dollars have been saved by business concerns through the practical application of employe suggestions. For example, in 1951, fourteen typical airplane companies saved more than $4,500,000 by adopting practical ideas obtained under incentive programs which were established to promote efficiency and economy in the aircraft industry. These plants received one suggestion every two minutes of each working day.

Last year, one aircraft company alone saved $3,000,000 in a cost reduction program that was based largely upon suggestions made by hourly employes who received cash awards and by supervisory employes who were given due credit on their personal performance records. This year, the same company has set a goal to save $5,000,000 under the same plan.

Various divisions of the General Motors Corporation have operated suggestion systems for a considerable number of years. In 1942, the suggestion plan was established on a company-wide basis and records kept of accomplishments. Since that date, 944,778 suggestions have been submitted to management officials. A total of 217,013 were adopted by the end of 1952 and over $9,000,000 was paid in awards. The maximum individual award is currently $2500, payable in United States Savings Bonds.

No matter how large or small the shop, the men who actually do the work are important cogs in the successful operation of the business. Their ideas are worth listening to and worth paying for. Convenient means should be provided for bringing their suggestions to the attention of top management.

Charles O. Herb
EDITOR



By JOHN J. WETZEL
General Master Mechanic
Dodge Division, Chrysler Corporation
Detroit, Mich.

BROACHING

Automotive Castings at 200 Feet per Minute

MANY parts for the new Dodge "Red Ram" V-8 engine are being produced faster and at lower cost by means of huge horizontal broaching machines using planer type, inserted tungsten-carbide-tipped broaching tools and operating at speeds up to 200 feet per minute. The use of inserted planer type tools on such machines instead of conventional solid broach inserts has resulted in less maintenance, easier replacement and adjustment, a smaller inventory of replacement tools, and longer tool life before resharpening is necessary.

On the Cincinnati two-way horizontal broaching machine shown in the heading illustration, all four surfaces of the cast semisteel cylinder head for the V-8 engine are both rough- and finish-broached in one complete cycle, with only two set-ups of the work. The remarkable ram speed of 200 feet per minute employed on this machine is made possible by a mechanical drive of the rack-and-pinion planer type, operated by a variable-voltage motor. With this ram speed, it is possible to broach 154 cylinder heads per hour. Approximately 3/16 inch of stock is re-

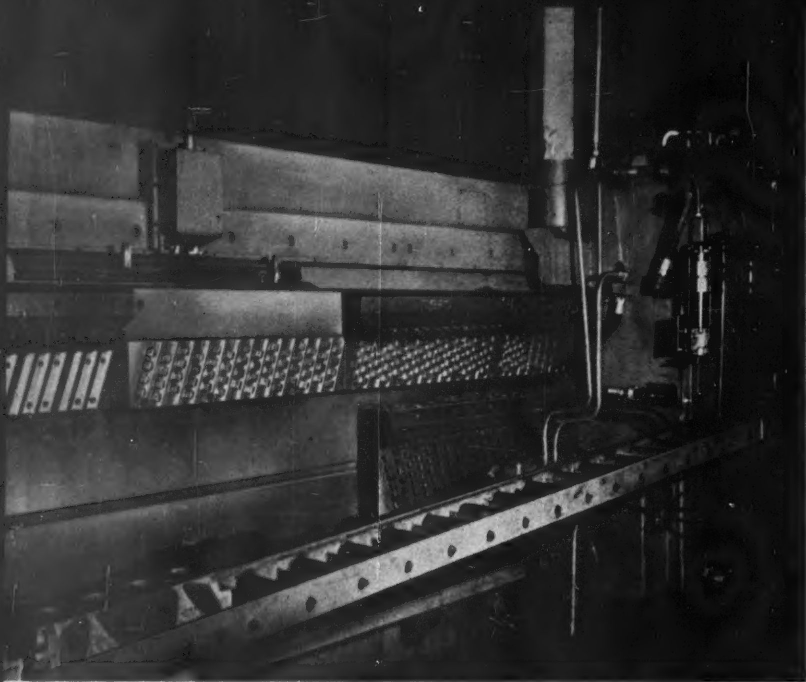


Fig. 1. Close-up view of the four broaches mounted in opposed pairs on the horizontal ram of the two-way broaching machine shown in the heading illustration

moved from each of the four surfaces, and flatness and parallelism of the broached surfaces are maintained within 0.003 inch. A very smooth finish is required on the combustion chamber side (bottom face) of the castings.

Cast cylinder heads are loaded into a hinged type work-holding fixture at the first station, and hydraulically clamped. When the operating button is depressed, the fixture is swung upward 90 degrees and the broach ram moves to the right to both rough- and finish-broach the tappet cover side (top face) and intake manifold face of the cylinder head. After the ram has reached the end of its stroke in this direction, the casting is automatically swung back to its loading position. A transfer mechanism rapidly moves the workpiece to a roll-over fixture which rotates it through an angle of 180 degrees and transfers it to the second station.

The operator reclamps the cylinder head and depresses another button that swings the fixture 90 degrees and moves the machine ram to the left. This movement of the ram rough- and finish-broaches the combustion chamber side and exhaust manifold faces of the casting. At the end of this return stroke of the ram, the completely broached cylinder head is automatically swung back to its loading position and unloaded on a gravity roller conveyor leading away from the machine. Chips fall on a conveyor located in a trench below the floor.

The four broaches employed on this machine are mounted in opposed pairs on the horizontal ram, as shown in Fig. 1. Each broach is made up of three holders—two of the holders containing inserted planer type tungsten-carbide-tipped broaching tools for roughing; and the third holder, solid-carbide inserted blades for finishing. When the ram moves to the right, 224 bits (1-inch square) rough-broach and twelve blades finish-broach the tappet cover side of the cylinder head. Simultaneously, 168 bits (5/8-inch square) rough-broach and twelve blades finish-broach the intake manifold face. These two broaches are seen along the top of the ram in Fig. 1, with the finishing blades shown at the left.

When the ram reverses and moves to the left, 240 bits (1-inch square) rough-broach and twelve blades finish the combustion chamber side of the casting. At the same time, 168 bits (5/8-inch square) and twelve blades rough- and finish-broach the exhaust manifold face. The first holder for these two broaches is seen along the bottom of the ram.

The successful application of inserted planer type tools on the two-way horizontal broaching machine led the way to the development of the large horizontal tunnel type machine shown in Fig. 2. This Cincinnati broaching machine is similarly tooled to rough- and finish-broach various surfaces on the cast semisteel cylinder block for the new V-8 engine. The complete unit is 159 feet long and, in reality, is comprised of three broaching machines connected to form one automatic transfer unit. The cylinder blocks are pushed through the tunnels—under and past carbide-tipped bits and solid-carbide blades, such as those shown in Fig. 3, by means of a rack-and-pinion planer type drive similar to that on the cylinder head, except that here the work moves with the ram under stationary broaching tools. There are approximately twenty-five blocks in the unit at all times, and a production of 133 per hour is possible.

In the first machine, the top face and four lugs on the sides of each casting are rough- and finish-

broached. The rough cylinder blocks are automatically loaded into fixtures with the front ends leading, located on four lugs, and spring- and wedge-clamped through two welch-plug holes. After broaching, the blocks are unclamped and rotated 180 degrees so that the tops of the castings face downward, front ends leading for entry into the next machine.

Pan rails, oil-filter mounting pads, bearing lock surfaces, and bearing half-bores of the cylinder blocks are broached in the second machine of the tunnel type unit. The castings are again automatically loaded—locating from the previously machined top face and side lugs—and clamped. After broaching, the blocks are again turned 180 degrees, front ends still leading.

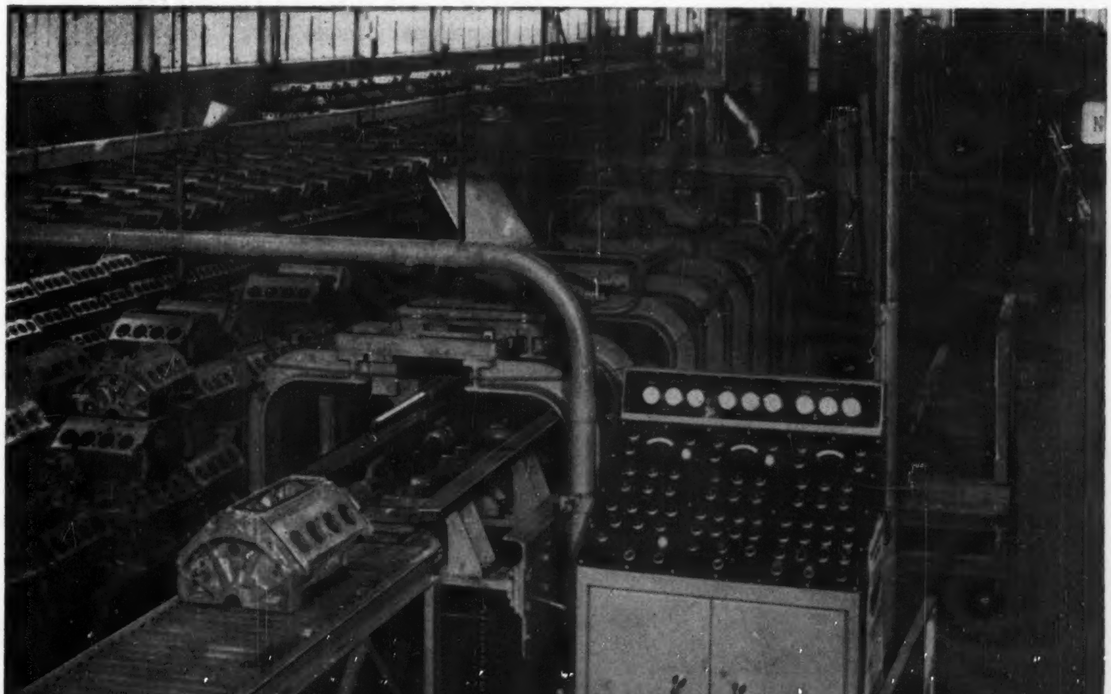
In the third machine of the tunnel unit, both bank faces (cylinder head mating surfaces) are rough- and finish-broached. The cylinder blocks are automatically unclamped and unloaded at the end of the unit. A gaging station is provided at the end of the first machine to check the castings periodically as well as after changing the broaches.

Broach-holders on the cylinder block machines are also equipped with planer type, inserted tungsten-carbide-tipped broaching tools for roughing, and solid-carbide inserted blades for finishing. The first block broaching tunnel contains three roughing holders and one finishing holder for machining the top face and four locating lugs on the sides of each casting. Each roughing holder (30 to 40 inches long) contains 56 bits, 1-inch square, and the finishing holder, made up of three sub-holders, contains nine blades.

The broaching bits in the first roughing holder are set to remove 0.097 inch of stock from each surface per foot of block travel. The bits are stepped so that the first bits remove a greater amount and the following bits a lesser amount. The average stock removal on the first holder is approximately 0.006 inch per bit. The second and third holders remove an average of 0.003 inch per bit. The first three finishing blades remove 0.002 inch of stock per blade; the second three, 0.001 inch per blade; while the final three are all set to the same height and serve to shave and smooth the surfaces being broached.

Three roughing holders and one finishing holder are also provided in the second tunnel for broaching the pan rails, oil-filter mounting pads, bearing lock surfaces, and bearing half-bore of the blocks. The roughing holders contain 168 bits 1-inch square, 62 bits 3/4-inch square, and 91 bits 5/8-inch square. A total of fifteen solid-carbide blades are mounted in the finishing holder—six for broaching the oil-filter mounting

Fig. 2. Tunnel type broaching unit 159 feet long, containing three in-line machines for broaching various surfaces on the cylinder blocks



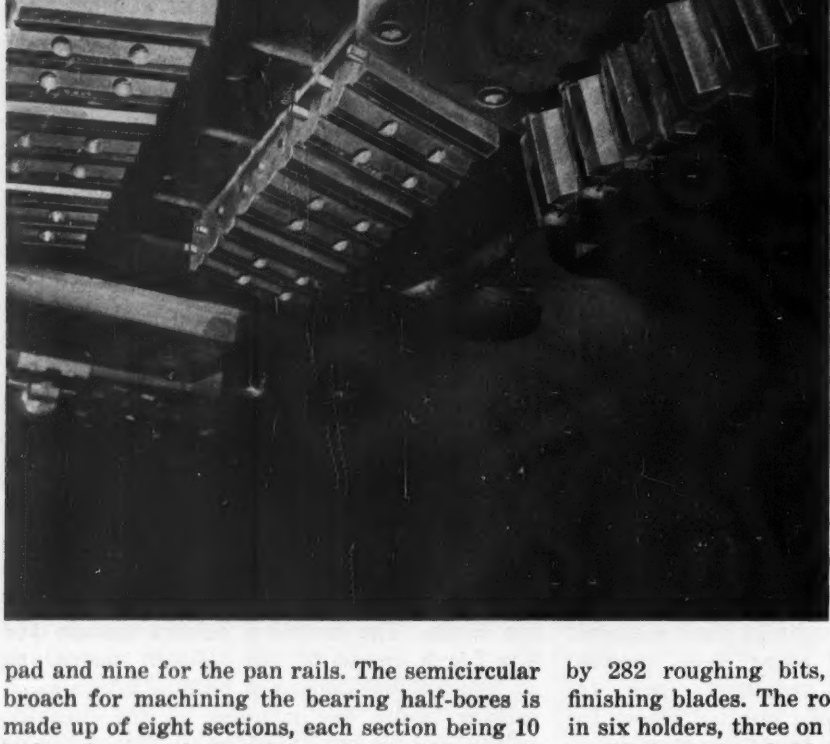


Fig. 3. Solid-carbide finishing blades and carbide-tipped roughing bits mounted in the machine seen in Fig. 2 for broaching cylinder blocks

pad and nine for the pan rails. The semicircular broach for machining the bearing half-bores is made up of eight sections, each section being 10 inches long and containing 40 carbide-tipped bits.

Both bank faces of the cylinder blocks are broached in the third machine of the tunnel unit by 282 roughing bits, 1-inch square, and 30 finishing blades. The roughing bits are mounted in six holders, three on each side, and the finishing blades in two holders, one on each side.

Typical of the inserted bits employed for rough-broaching both the cylinder heads and blocks is the one seen in Fig. 4, which is 3/4 inch long by 1 inch wide and 1/4 inch thick. The bits were originally made from Carboloy Grade 883 carbide, but it was found from experience that Grade 44A provided longer life between sharpenings. While the latter grade is slightly less resistant to wear, it is tougher and therefore has more shock resistance. The shanks to which the carbide tips are brazed are made from S A E 1040 steel.

Finishing blades are made from solid carbide blanks of the same grade, 3/4 inch long by 7 1/2 inches wide, and 1/4 inch thick. A back rake angle of 9 degrees is ground on the top of the solid-carbide finishing blades. No side rake angle is ground on either the roughing bits or the finishing blades, since the shearing action is obtained by setting the tools at an angle of 20 degrees in their holders. Tapped holes are provided in the top faces of the roughing bit shanks to accommodate pullers for easy removal.

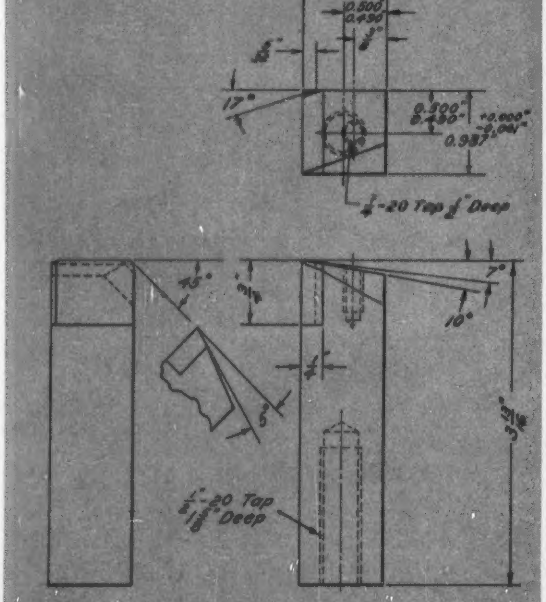


Fig. 4. Planer type tungsten-carbide-tipped bit used for rough-broaching cylinder heads and blocks on the machine shown in heading illustration and Fig. 2

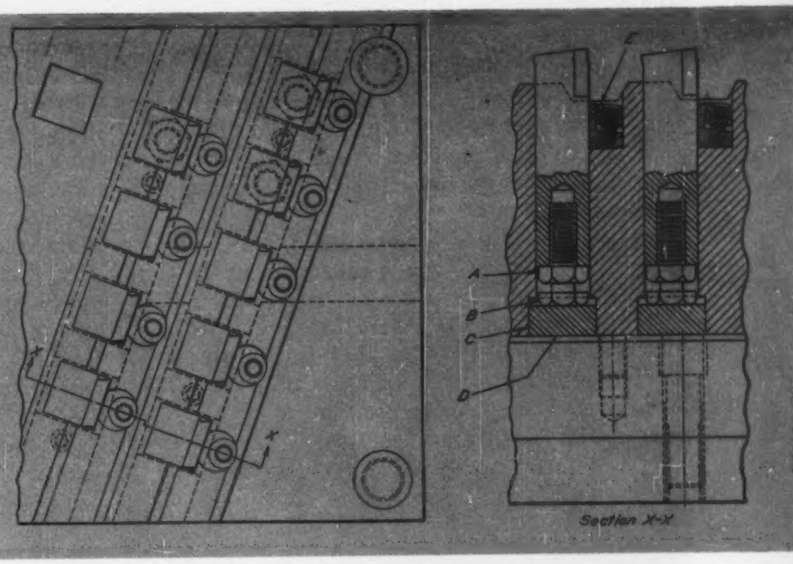


Fig. 5. Partial drawing of a rough-broaching holder, showing the staggered arrangement of alternate rows and how the carbide-tipped bits are secured in the holder

The bottom face of each roughing bit shank is tapped to hold a height-adjusting screw. As shown in Fig. 5—which is a partial drawing of one of the rough-broaching holders—a lock-nut *A* holds the screw *B* in its pre-set position. The heads of the screws rest on back-up blocks *C*. They, in turn, are supported on the stepped surface *D* of the holder. This stepped surface provides for the proper setting of the tool bits to obtain the desired chip per tooth, while permitting the individual bits to be pre-set to a uniform over-all height.

This arrangement of using roughing bits having a uniform over-all height is a great advantage, since it permits keeping a smaller inventory of replacement tools. For example, the 5/8-inch square roughing bits can be used interchangeably for broaching the intake and exhaust manifolds of the cylinder head, as well as the oil-filter mounting pad on the cylinder block. Also, easier maintenance of the broaching machines is possible since no adjustments are necessary when inserting new or sharpened tools in the holders. As can be seen in Fig. 5, the holders need not be

Fig. 6. Set-up employed for adjusting the over-all height of sharpened rough-broaching bits. Lock-nut and screw are adjusted to required indicator reading

removed from the broaching machines for replacement or sharpening because the individual bits can be replaced in a few minutes. The rough-broaching bits are secured in the holder by means of McCrosky screw-jacks, as shown at *E*. Roughing bits in alternate rows on the holder are staggered so that they broach the entire surfaces of the castings.

The set-up employed for adjusting the over-all height of sharpened rough-broaching bits is seen in Fig. 6. Tools are clamped in a V-block with their upper ends contacting a gage-block. Then the lock-nut and screw are adjusted until the required dial-indicator reading is observed. Only one fixed-height gage is required to adjust these tools after sharpening. The 1-inch square bits are set to an over-all height of 4.522 inches.

A partial drawing of one of the finishing holders, with solid-carbide broaching blades in place, is shown in Fig. 7. Increased depth of cut for each successive blade *A* is obtained by inserting gibs *B* in the sides of the holders. The gibs have a taper of 5/32 inch per foot. When necessary, shims are provided after sharpening the finishing blades.The blades are held by blocks *C*, which are secured by screws *D*.

A Cincinnati two-way hydraulic horizontal broaching machine used for V-8 engine production at the Dodge plant is illustrated in Fig. 8. Joint faces, bearing lock surfaces, and the bearing half-bores of the crankshaft main-bearing caps are all broached in one pass. The machine is equipped with two sets of broaches (upper and lower) and two hinged, hydraulically

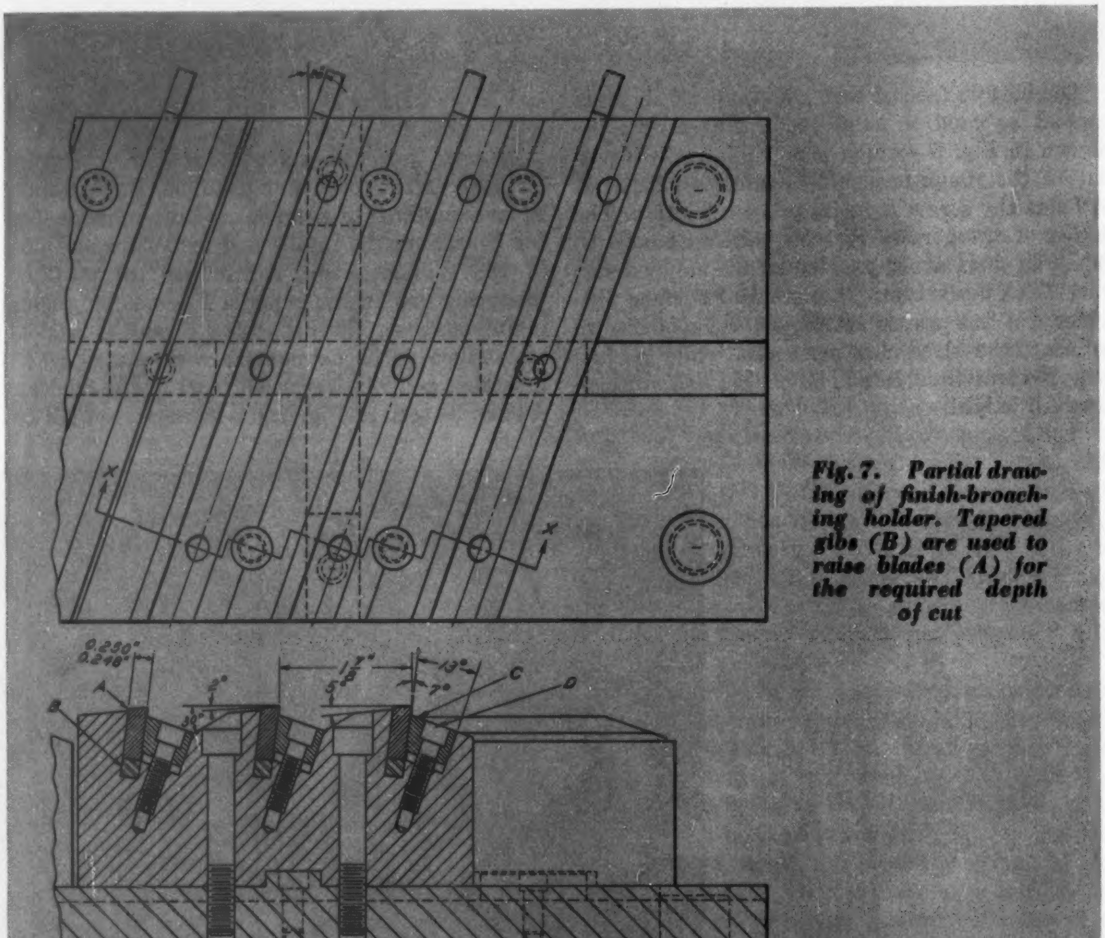


Fig. 7. Partial drawing of finish-broaching holder. Tapered gibs (B) are used to raise blades (A) for the required depth of cut

Fig. 8. Two-way horizontal machine for broaching the joint faces, bearing lock surfaces, and half-bores of crankshaft main-bearing caps

actuated fixtures, so that a broached casting can be unloaded and a rough casting loaded while another casting is being broached. The broach ram operates at a speed of 90 feet per minute, and a production of 240 castings per hour is obtained. Each casting contains five caps that are sawed apart after machining.

A close-up view of the carbide-tipped inserts employed on this machine is shown in Fig. 9. Both upper and lower broach-holders on the two-way machine require about 200 inserted bits. The half-round broach for the bearing bores is made in four sections, each section being 10 inches long and containing 40 carbide tips. Each tip removes about 0.004 inch of stock. This method was used to conserve ram length.

Fig. 9. About 200 carbide-tipped bits are required on both of the broaches employed on the machine illustrated in Fig. 8

Maintaining Constant Surface Cutting Speed

By JOHN L. DUTCHER
Industrial Engineering Department
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PRACTICALLY all lathes and boring mills are equipped to permit the selection of a number of different table or spindle speeds, but, in general, the speed chosen is constant while any given cut is being taken. In facing operations on such machines, the surface cutting speed will change as the diameter of the cut changes. If, however, the machines are equipped with a constant cutting speed drive, facing cuts can be taken at a constant surface cutting speed by causing the spindle speed to increase as the tool moves to smaller diameters.

Constant surface cutting speed has been used on a few special machines for many years, but it has taken the requirements of jet-engine manufacturing to bring this type of machining into large-scale use. Jet-engine rotor wheels must have a fine surface finish and be produced in large quantities. Thus, they require a machine which will produce this fine finish and also give maximum production. These two requirements make constant cutting speed quite essential on most machines, and the experience gained on this work is causing constant cutting speed to be used more and more on a variety of other turning jobs.

Why Constant Cutting Speed is Desirable

The use of a constant cutting speed drive results in improved performance in any facing operation. It does, however, add somewhat to the cost and complication of the machine. Therefore, various factors must be weighed to determine whether constant cutting speed provides sufficient advantages for a specified job to justify this added cost. In many cases it will, since constant cutting speed improves machine performance in a number of ways.

For each operation there is a maximum practical cutting speed which cannot be greatly exceeded without an adverse effect upon the work and the tool. Obviously, if this maximum speed is maintained over a large portion of the work to be machined, the machining time will be reduced and the productivity of the machine will consequently be increased. The accompanying table shows the per cent saving in machining time (for work with different ratios of maximum to minimum diameter) when machined partially or completely at constant cutting speed, as compared with the time required if the work were to be rotated at a constant speed. From this table it will be noted that savings up to 47 per cent in machining time may be expected in some work. It is also evident that little additional time saving will result from increasing the ratio of diameters for which constant cutting speed is provided above 3 to 1 or 4 to 1.

In many machining operations, a smooth surface finish, which is also dependent upon cutting speed, is required. In some cases, such as in the machining of jet-engine rotor wheels, surface finishing is important enough to justify constant

Possible Savings in Time by Machining at Constant Surface Cutting Speed

Ratio of Maximum Diameter of Work to Minimum Diameter of Work	Adjustable Speed Range of Spindle Drive					
	2 to 1	3 to 1	4 to 1	8 to 1	15 to 1	20 to 1
	Per Cent Savings in Time Compared with Constant Revolutions per Minute of Work					
5 to 1	34.4	38.9	39.9	...	...	...
8 to 1	35.7	41.3	42.9	43.8	...	...
15 to 1	36.6	42.9	44.9	46.5	46.7	...
20 to 1	36.9	43.4	45.4	47.2	47.5	47.5

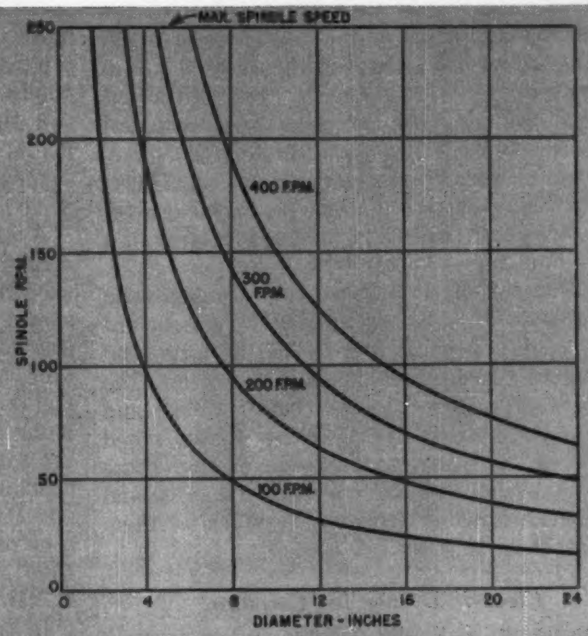


Fig. 1. Examples showing the necessary relationship between cutting diameter and spindle speed to give constant surface cutting speeds

cutting speed over the full range of diameters, even though a smaller range of speed is sufficient to provide essentially maximum production.

With most tools, and particularly with carbides, tool life is dependent upon cutting speed. Since a constant cutting speed drive permits machining at more nearly the optimum cutting speed, tool life will be improved.

Each of these factors may assume larger or smaller proportions depending upon the particular type of machine and the use to which it will be put. They must all be considered when deciding whether or not a machine shall be equipped for constant cutting speed operation.

Drive Requirements for Constant Cutting Speed

Examples of the relationship that is necessary between spindle speed and cutting diameter to permit constant cutting speed are shown in Fig. 1. These are simply hyperbolic curves, the spindle speed being doubled each time the diameter is halved. It is evident that the relationship between spindle speed and cutting diameter cannot even be approximated with a constant speed drive and a number of gear ratios, since it is impractical to change gears in the middle of a cut. It should also be realized that a good job of holding constant cutting speed cannot be accomplished by the operator if he is given an adjustable speed drive having simply a rheostat to manually adjust speed.

With such an arrangement, the operator has no direct indication of what the cutting speed is at various diameters and spindle speeds, and thus the cutting speed obtained is completely dependent upon a rough estimate on his part. Also, at small diameters, the speed must be varied much more rapidly than can be done accurately with such a manual control.

It is therefore necessary to equip the machine with an adjustable speed drive, and also some means of automatically controlling the drive speed as a function of the tool position or the cutting diameter. It is desirable to provide constant cutting speed over the full range of diameters at which machining will be done, and also be able to obtain a variety of cutting speeds at any given diameter. In some cases this is accomplished, but there are a number of factors that may limit the constant cutting speed range.

The mechanical construction of the machine and the method of chucking the work place a definite limit on the maximum speed of rotation of the work, and consequently limit the cutting speed at small diameters. If a machine has a maximum practical spindle speed of 255 R.P.M., a cutting speed of 400 feet per minute cannot be obtained at diameters smaller than 6 inches. At smaller diameters, a spindle speed higher than 255 R.P.M. would be required. However, lower cutting speeds could be held constant from the maximum diameter to one less than 6 inches.

The power required to drive the spindle or table of a machine is made up of two parts: the

power required to remove the metal; and the windage and friction of the machine and work. The power needed is essentially proportional to the rate of removing metal. If the depth of cut and the feed per revolution remain constant, and the work is machined at constant surface speed, the rate of removing metal is constant. Therefore, the horsepower required is constant regardless of whether the tool is cutting at a large or a small diameter.

The second part of the load—windage and friction—is apt to be neglected in the selection of a drive, but very often it is just as large and occasionally larger than the tool load itself. The horsepower required to overcome windage and friction increases rapidly as the spindle speed increases. It is necessary to determine these power requirements as precisely as possible and then select a motor drive which will meet them as closely as is practical.

Electric Drives for Constant Cutting Speeds

Direct-current electric motors are inherently rated at constant horsepower in their field control range (from base speed to maximum speed) and at constant torque (or horsepower proportional to speed) below the motor base speed, where speed adjustment is obtained by adjusting armature voltage. A 4 to 1 adjustment of speed by motor field control is about the maximum practical range for an application of this type. A typical drive might be rated at 100 H.P., 400 to 1600 R.P.M. This drive would provide the full 100 H.P. at any speed from 400 to 1600 R.P.M., and reduced horsepower at lower speeds —for example, 25 H.P. at 100 R.P.M., or 50 H.P. at 200 R.P.M.

Available horsepower for various cutting speeds and diameters of cut when this drive is used in a constant cutting speed application is shown in Fig. 2. Zone A represents speeds above the maximum motor or spindle speed. In this zone, operation is impossible because the motor and the spindle are required to exceed their maximum safe speeds. Therefore, at small diameters the surface cutting speed is limited. In Zone B, constant surface cutting speed can be obtained, and the full rated horsepower is available. This zone represents motor speeds between base speed (400 R.P.M.) and maximum speed (1600 R.P.M.).

In Zone C, constant cutting speed may also be obtained, but the horsepower available is limited to the values shown because the motor is operating below base speed. If a cut is to be taken at 100 surface feet per minute with gear ratio *X*, about 35 per cent rated horsepower will be available at a 60-inch diameter, and 50 per cent at 40 inches. The horsepower will increase until rated horsepower is available at 20-inch and

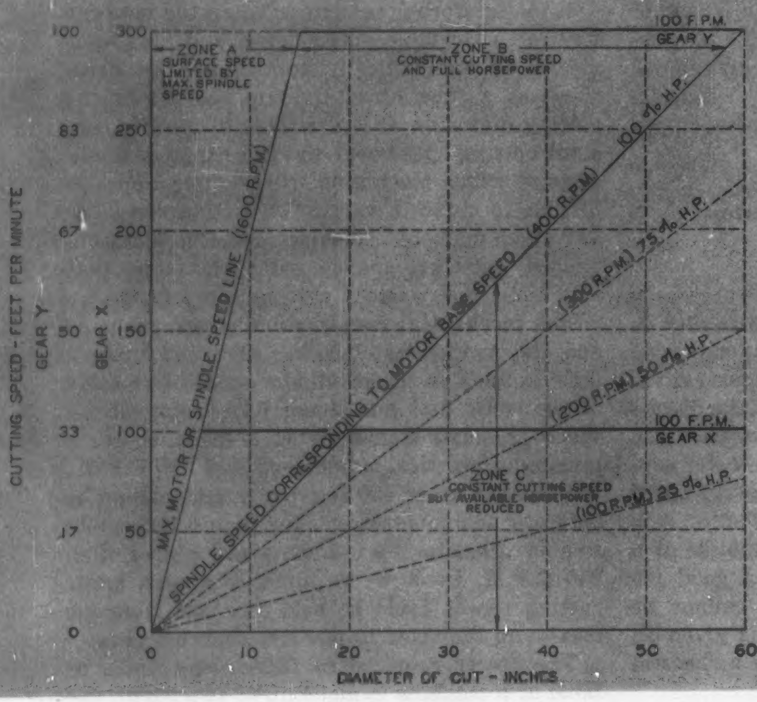
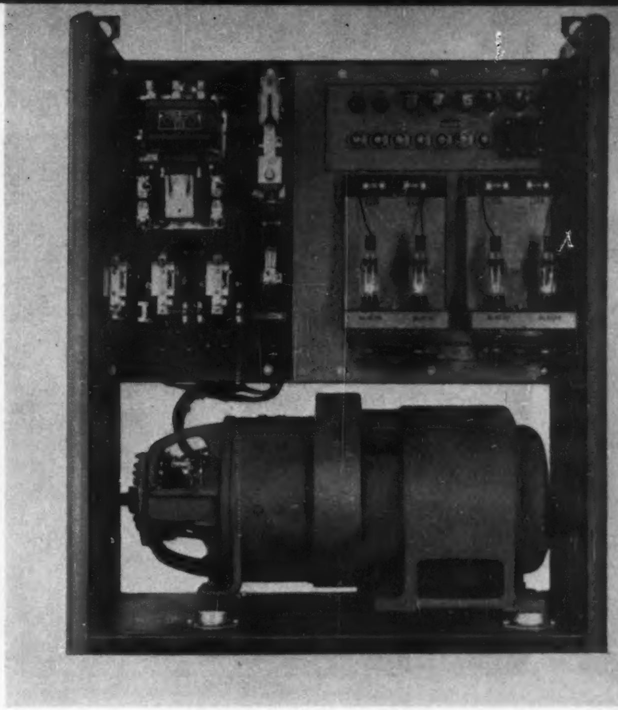


Fig. 2. Chart which may be employed to determine available horsepower and range of cutting speeds for a typical drive rated at 100 H.P., 400 to 1600 R.P.M.

Fig. 3. Speed Variator power unit showing magnetic and electronic controls and motor-generator set. The enclosing covers have been removed to show unit



smaller diameters. However, the maximum motor speed is reached at a 5-inch diameter, and therefore the surface cutting speed will automatically be reduced at diameters below 5 inches, coming down to about 50 feet per minute at a diameter of 2 1/2 inches.

If a second gear ratio Y is provided, a cutting speed of 100 surface feet per minute is available at full horsepower from 15 to 60 inches in diameter for heavier cuts on larger work-pieces. The chart shows that a constant cutting speed drive does not provide all surface cutting speeds at all diameters of cutting, and that there can be a limit on the horsepower available for certain cuts. It will be noted, that by providing a number of gear ratios, as well as the constant cutting speed drive, a satisfactory arrangement can be obtained. Similar charts may easily be drawn for any machine and will be found helpful in selecting the speed and power ratings of the drive and the gear ratios to be provided. Such a chart will also be found useful in the operation of the machine.

Adjustment of the speed of the drive motor is obtained at higher speeds by motor field control, and at lower speeds by varying the armature voltage through field control of a direct-current generator. Because of the relatively wide speed range and fairly accurate speed control required, electronic Speed Variators (electronically controlled, packaged Ward Leonard drives) can be used. A typical Speed Variator power unit showing the motor-generator set and the magnetic and electronic controls is seen in Fig. 3. This particular unit is rated at 15 H.P.

A schematic diagram of the complete electric equipment for this power unit is shown in Fig. 4. The curve at the upper left shows the desired relationship between spindle speed and cutting diameter for one single cutting speed. Both the table and the cross-slide of the machine are driven by the main direct-current drive motor. The speed of this motor is controlled by an electronic panel that adjusts the motor field current and also the field current of the generator.

In this case, a linear rheostat is geared to the lead-screw. When this rheostat is connected in a simple resistor network, as shown, the output voltage V_R is directly proportional to the table speed required to give constant surface cutting speed. A tachometer generator mounted on the drive motor provides a voltage V_T, which is directly proportional to the drive motor speed. This speed voltage is compared with the output voltage of the rheostat V_R, and the electronic control causes the motor speed to change as required to keep the two voltages equal. Consequently, constant cutting speed is maintained.

A second rheostat is generally provided, which allows the operator to adjust the surface cutting speed and thus select the correct speed for the work being done. This is one control arrangement that can be and has been used to provide constant cutting speed. Two modifications of this arrangement are also in general use.

On many machines, the rheostat is replaced with an adjustable reactor, the position of which is controlled by a cam fastened to the cross-slide. This arrangement will also supply a voltage V_R which is proportional to the table speed required for any position of the slide. A cam-operated rheostat has also been used recently on a few applications. Many drives are built which do not make use of a tachometer to provide a speed signal. Motor armature voltage and field current are used for this purpose.

Rheostat or Reactor Control of Spindle Speed

For the purpose of relating the spindle speed to the position of the tool, a small control device is needed. Either a rheostat or a reactor can be used for this purpose. The reactor consists of a magnetic core, coils, and an armature which may be moved through approximately 1/2 inch to vary the reactance over a wide range. The reactor armature is caused to move by a cam connected to the cross-slide. The coils of the re-

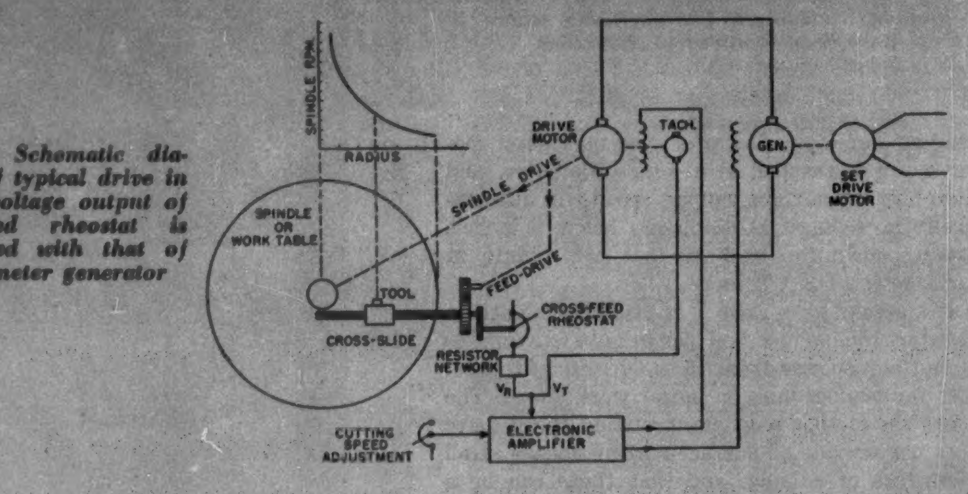


Fig. 4. Schematic diagram of typical drive in which voltage output of cross-feed rheostat is compared with that of tachometer generator

actor are electrically connected in a bridge circuit. The output of the circuit is rectified to give a direct-current signal, which varies with the position of the reactor armature. This direct-current output voltage is then used to control the speed of the Variator drive. Such an arrangement is shown at A in Fig. 5.

The rheostat that has most generally been used for this purpose is a multi-turn linear rheostat. Because of its rotary motion, the rheostat may be geared directly to the lead-screw, as seen at B in Fig. 5. The rheostat may then be connected with resistors so that the output voltage is exactly the hyperbolic function required for relating spindle speed to tool position.

The reactor is completely enclosed in a metal container and there is no sliding contact. It is used more than the rheostat because of this ruggedness, and because the flexibility of cam design permits its use on machines equipped with single dimension tracer controls that have 45-degree slides. The rheostat will not give accurate results when such a slide is used, because the tracer can cause the tool to move across the work without the lead-screw or the rheostat connected to it being turned. A typical reactor unit is shown in Fig. 6. The plunger (which extends to the left) is moved in and out by a cam mounted on the machine. A spring inside the enclosure tends to hold the plunger in an extended position.

The principal advantage of a rheostat, such as the one shown in Fig. 7, is its accuracy. It will hold a cutting speed with far greater accuracy than is practical with a reactor. The rheostat can be geared directly to the lead-screw, and no special cam is required. The life of this unit has been proved to be quite satisfactory when used in this manner, and its use allows the control equipment to be slightly less complicated and somewhat less expensive. In general, a rheostat is more suitable for a general-purpose machine where a fairly wide range of cutting speeds is needed and an accurate control device required. The greater flexibility of the reactor causes it to be used on single-purpose machines that employ single-dimension duplicators.

A third control unit, which has only recently been made available, appears to overcome most

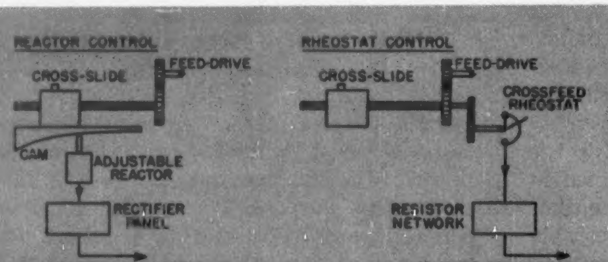


Fig. 5. Schematic diagram showing how either an adjustable reactor or a multi-turn rheostat may be used as a control device

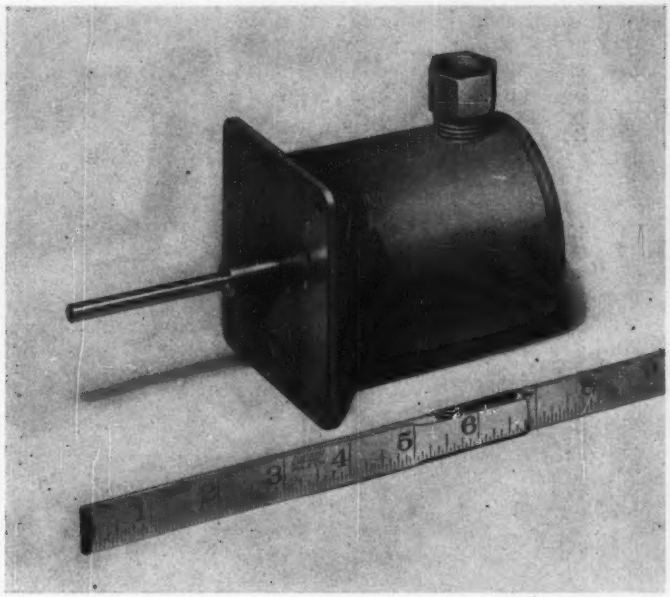


Fig. 6. Adjustable reactor unit designed for mounting on a machine tool to control the speed in constant cutting speed applications

of the disadvantages of both the rheostat and the reactor described. This unit is a special rheostat, designed to be suitable for cam operation (Fig. 8). A 1/2-inch movement of the plunger causes a slider to move over the full length of a tubular resistance element. The characteristic of this unit will be far more consistent and predictable than that of the reactor. Therefore, a single cam design can be used for any number of similar machines and yet provide accurate cutting speed control. It has the flexibility of the reactor because of the cam operation. It has a resistance element which may be connected to a direct-current circuit, thereby simplifying the required control equipment.

Tests and operating experience show that the life of this special rheostat will be well beyond that required by this application. Because of these advantages, it is expected that this unit will eventually replace the reactor on many machines. However, where a high level of accuracy over a wide range of diameters is required, the multiple-turn rheostat will undoubtedly find considerable use.

Tachometer Speed Control

Although it is used in somewhat less than a majority of present installations, tachometer speed control provides sufficiently improved performance to justify its use in most cases. The arrangement of the electric drive equipment for tachometer speed control is shown schematically in Fig. 9. The cam shown at the left can be designed so that the output voltage of the rectifier V_R is very nearly proportional to the desired spindle speed.

The tachometer is connected to the drive motor to provide a feed-back voltage which is proportional to the motor or spindle speed. This feed-back voltage is compared with V_R, and the electronic control works upon the generator and motor fields to provide a motor speed which will cause these two voltages to be equal. Thus the spindle speed is always kept exactly proportional to the output of either the reactor unit or the

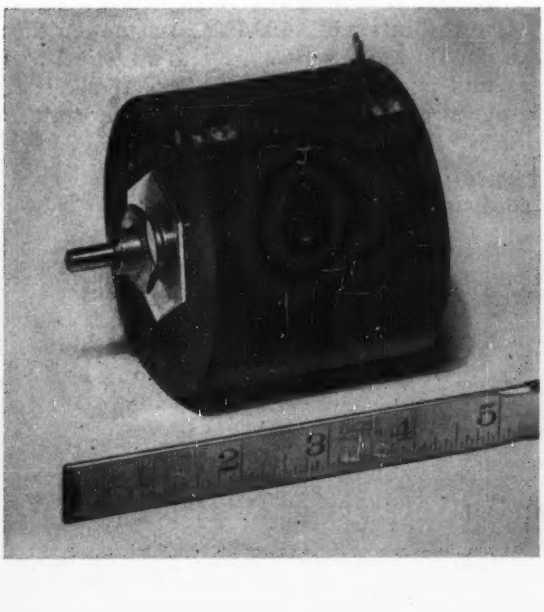


Fig. 7. Typical multi-turn rheostat which can be geared to the cross-feed lead-screw of the machine tool for speed control

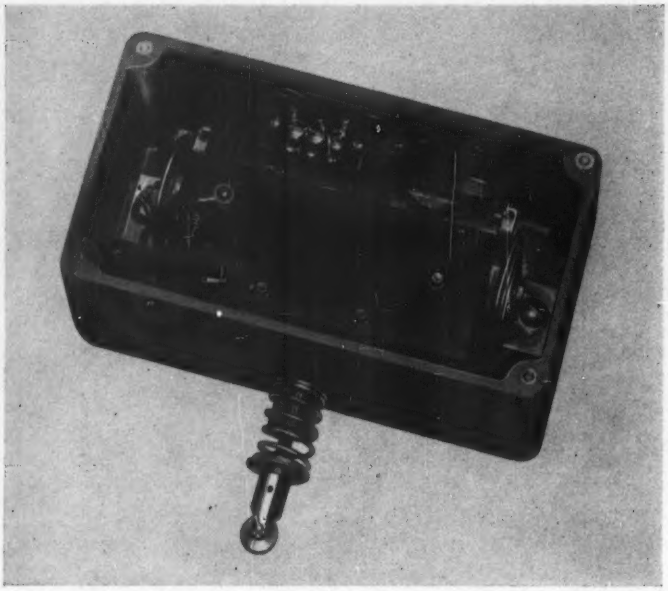


Fig. 8. Special rheostat designed for cam operation. A 1/2-inch plunger movement results in full rheostat travel. Dimensions are about 8 by 5 by 4 inches

rheostat. Consequently, constant surface cutting speed is accurately maintained.

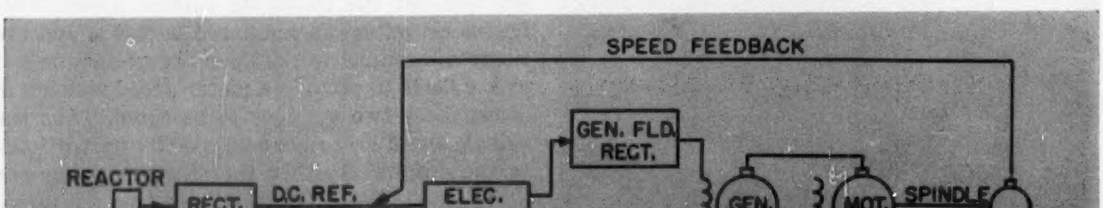
If tachometer speed control is not used, the tachometer feed-back voltage is not available. Then the voltage V_R is compared with motor armature voltage (with IR compensation) at speeds below motor base speed. For higher speeds in the motor field range, the voltage V_R is used to gradually weaken the motor field as it increases. With this type of control, the speed of the drive motor is no longer proportional to the voltage V_R from the reactor unit. It is therefore necessary to take this non-linear relationship into account in making the cam if constant cutting speed is to be maintained with any degree of accuracy.

It is possible to plot a curve showing the relationship between reactor position and motor speed, and use this curve in laying out the cam. However, if this same cam design is then used for similar machines, it is assumed that other reactors and rectifiers have the same characteristic as the tested unit, that the electronic control has the same input to output characteristic, and that the relationship between field current and speed for the motors will be exactly the same. These assumptions are not very accurate, particularly when the electronic control handles a motor with a wide field range, and variations in cutting speed of 10 to 20 per cent or more may be expected. Also, the cam made in this manner is suitable for only one surface cutting speed. If adjustment of cutting speed is necessary, additional errors will occur.

An Application of Constant Cutting Speed Drive

One application of a 100-H.P., constant cutting speed, adjustable-voltage drive to a vertical boring mill is shown in Fig. 10. This Giddings & Lewis machine is equipped with a rheostat as

Fig. 9. Schematic diagram of electric drive equipment with tachometer speed control. Cam at left controls output voltage of rectifier (V_R)



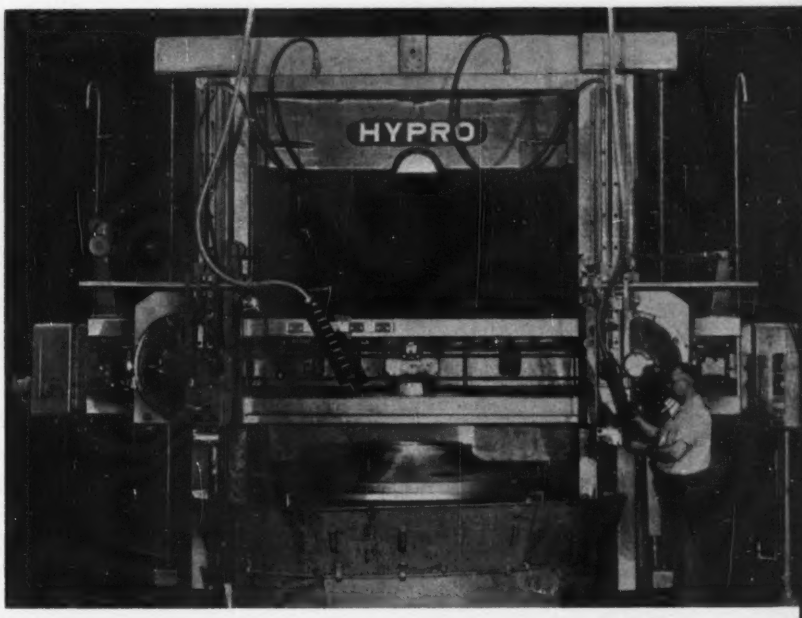


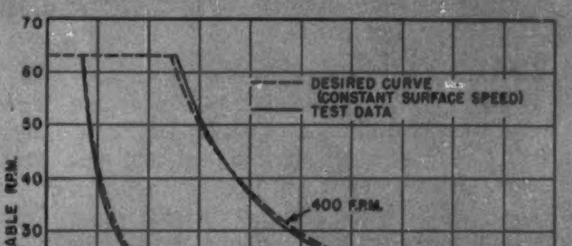
Fig. 10. A 100-inch vertical boring mill equipped to machine at a constant surface cutting speed. A large turbine rotor wheel is seen mounted on table

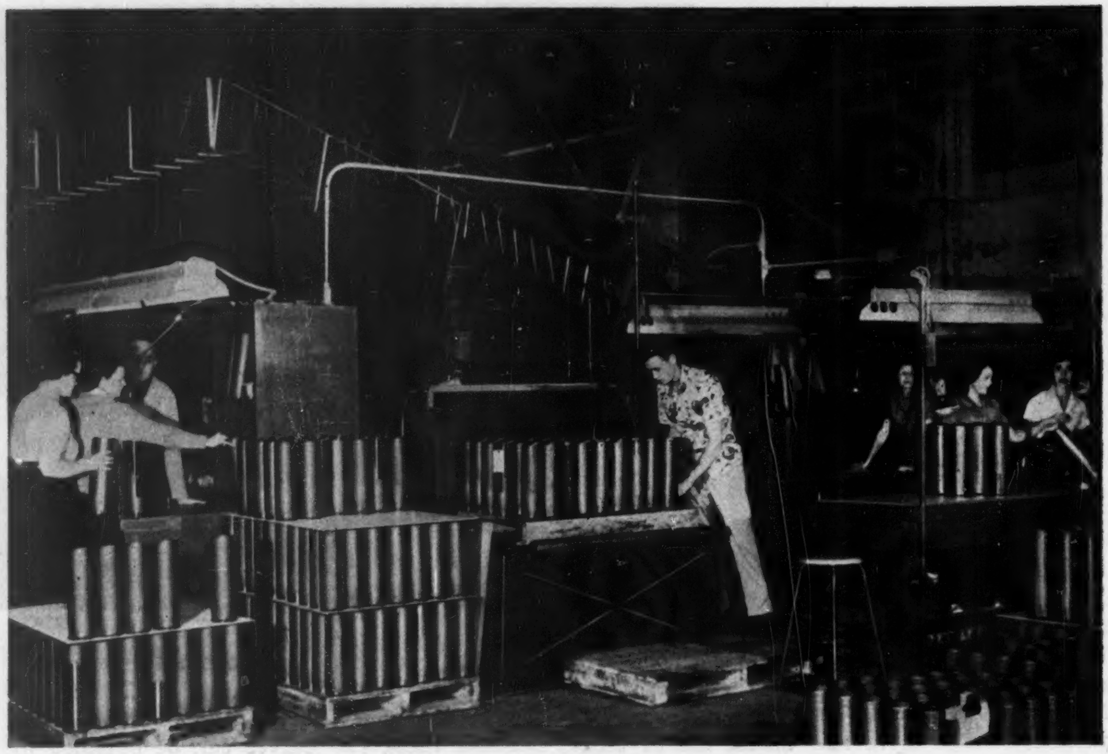
the control element. The rheostat is housed in a small protrusion at the end of the rail, where it is geared to a cross-feed lead-screw. This adjustable-voltage drive also makes use of tachometer speed control and two-dimensional electric tracer control.

It will be noted from the work mounted on the table (a large turbine rotor wheel), that a long facing cut is required. Thus, a constant cutting speed is needed over a wide range of diameters. This machine is equipped to maintain constant cutting speed from the maximum cutting diameter to one-twentieth of this diameter. Because the machine is used for a number of different types of work, cutting speed is adjustable over a fairly wide range.

Actual test data taken from this machine, showing the performance at two different cutting speeds, is presented in Fig. 11. Any speed between these two curves can be obtained by adjusting a rheostat in the pendant station. The curves indicated by broken lines show the relationship necessary between table speed and diameter to hold the cutting speed exactly constant. The solid line curves are the actual test curves that were obtained when set for these two cutting speeds. The maximum deviation of the test curves from the theoretically perfect (broken line) curves is 5 per cent. These results were obtained without any special tailoring of the equipment because tachometer speed control was used.

Fig. 11. Test data taken with machine shown in Fig. 10. Maximum variation in actual cutting speed from the theoretically perfect is plus or minus 5 per cent





Mass-Producing 105-Millimeter Cartridge Cases

Private enterprise, using an army ordnance facility, now operates the world's largest factory for manufacturing cartridge cases

By C. H. WUERZ
Formerly Officer in Charge of the Riverbank Ordnance Plant

ARMAMENT-MAKING is big business—a mass-production business—and at the Riverbank, Calif., Army Ordnance Plant, it is being conducted on an energetic and efficient scale. This former World War II aluminum facility houses the world's largest cartridge case factory, and has already contributed materially to the country's defense strength.

The Norris-Thermador Corporation—which as the Norris Stamping & Mfg. Co. helped to pioneer the drawing of steel cases in World War II—is the prime contractor, and runs the government-owned installation. When a steel processing building is completed this fall, cartridge case manufacture will be entirely integrated, from the spheroidizing of the mill plate to the packaged product ready for shipment to the armed services. The new building will process sufficient steel to serve two other ordnance plants as well.

The conversion of a flat disc of steel, which for a 105-millimeter cartridge case is approximately 1/2 inch thick and 7 inches in diameter, requires nearly fifty distinct manufacturing operations, with inspections made at every critical point. As an initial step, the steel stock, roughly 38 by 111 inches, is sheared. Then the discs are blanked on a 500-ton Minster press or a 1000-ton Clearing press. Each blank is visually inspected, and rough edges are snagged off. After being washed, pickled, Bonderized, and coated

Fig. 1. Pre-cupping is the first press-line operation in converting steel discs to cartridge cases.

with soap, the blanks are sent to one of the production lines.

There are now seven such lines in the plant. Except for the varying tonnages of the fifty-nine presses, the lines are identical. Each is complete in itself, and normally, cartridge cases are processed within one line down to packing and shipping. However, the conveyor system in the plant is sufficiently flexible to permit cases to be switched from one line to another, if necessary to meet production schedules.

At the start of the line, the discs are pre-cupped, as shown in Fig. 1, in a 250-ton press made by the Hydraulic Press Mfg. Co. The pre-cupped piece resting on the rear of the die shows the shape acquired in this operation. Cleaning and the first in-line inspection follow. All ruptured pre-cups are rejected.

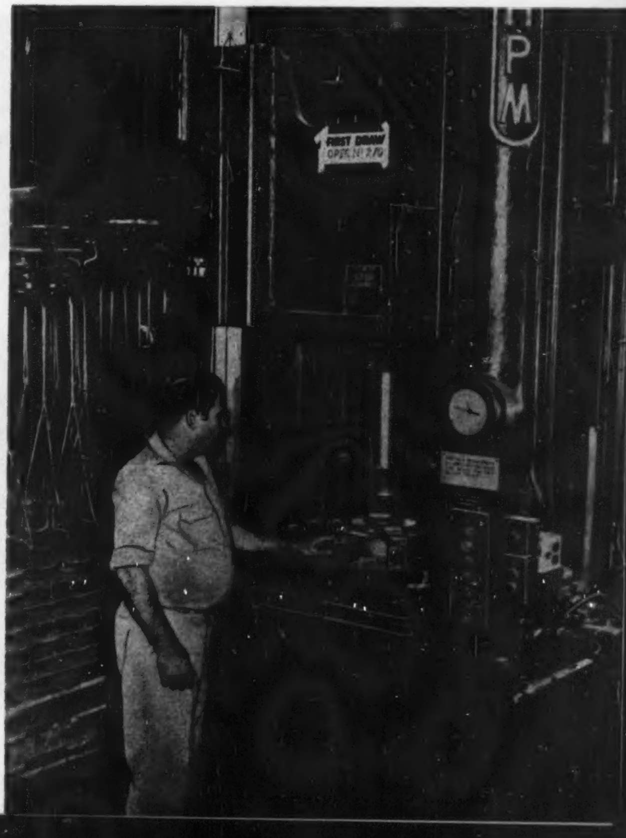
In cupping, the center section which will become the head of the case is flattened slightly and held securely while the outer area of the work is forced closer to the punch. As in pre-cupping, a 250-ton press is used. The cupping punch is more slender than the pre-cupping one, and gives the work the final direction of draw.

A 150-ton HPM press performs the first draw, illustrated in Fig. 2. The cup retains its head thickness but its wall is extended nearly 2 inches. This and the subsequent draws are "push-through" operations, the work being pushed through die rings in the bed and ejected under the press. A reverse chute delivers the drawn cases to an inspection station at the rear of the press. The parts are cleaned after the first draw, and to eliminate the work-hardening developed in the drawing, they are then annealed in the Surface Combustion controlled-atmosphere furnace seen in Fig. 3.

A combined second and third draw operation follows. Performed on a 150-ton press, this step employs a two-stage die. The ram descends for the second draw, dwells momentarily, and continues downward for the third draw. Since these draws leave a ragged edge around the mouth of the work, Bliss nibblers, Fig. 4, then chew a temporary trim line on the end of the cases. The nibbling permits the easy entrance of the ram die to be used subsequently, preserving its finish and preventing the inside of the cases from becoming scored.

Next comes a preheading operation on a 1500-ton HPM press. A feature of this press is its two-position shuttle feed, shown in the close-up view, Fig. 5. The bed has a shuttle motion, alternately indexing its two stations to working

Fig. 2. In the drawing operations, the work is pushed through the die rings in the bed of the press and ejected onto a conveyor.



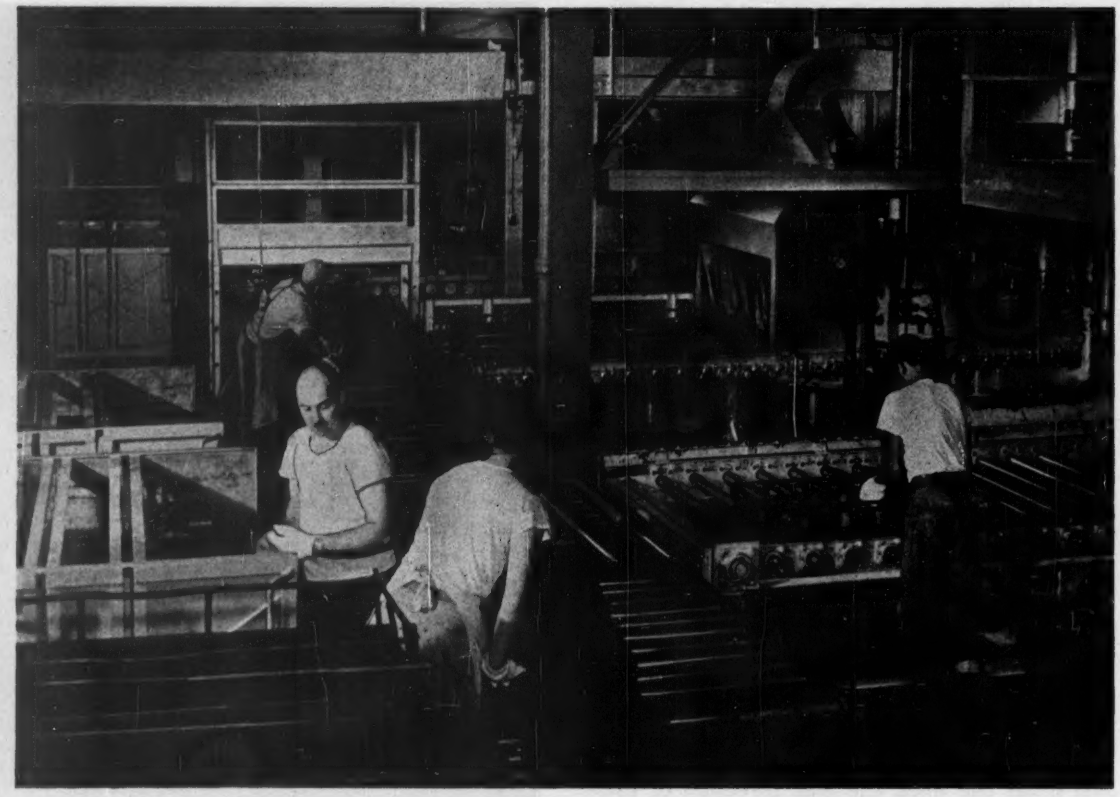


Fig. 3. Cartridge cases go through this controlled-atmosphere annealing furnace to remove the work-hardening of the first draw. Prior to annealing, the cases are cleaned thoroughly.

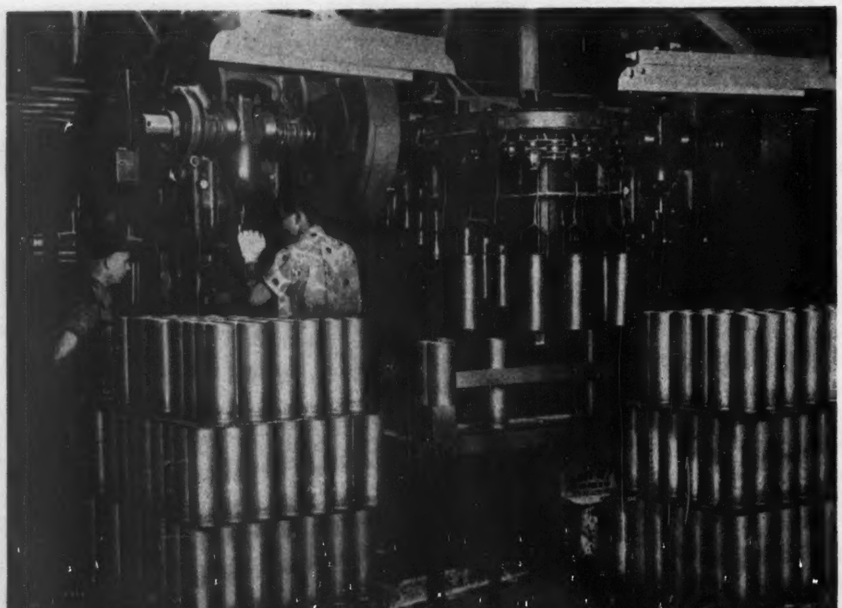


Fig. 4. Nibblers, located conveniently at the rear of the draw presses, bite off the ragged edge that is left around the mouth of the cartridge case.

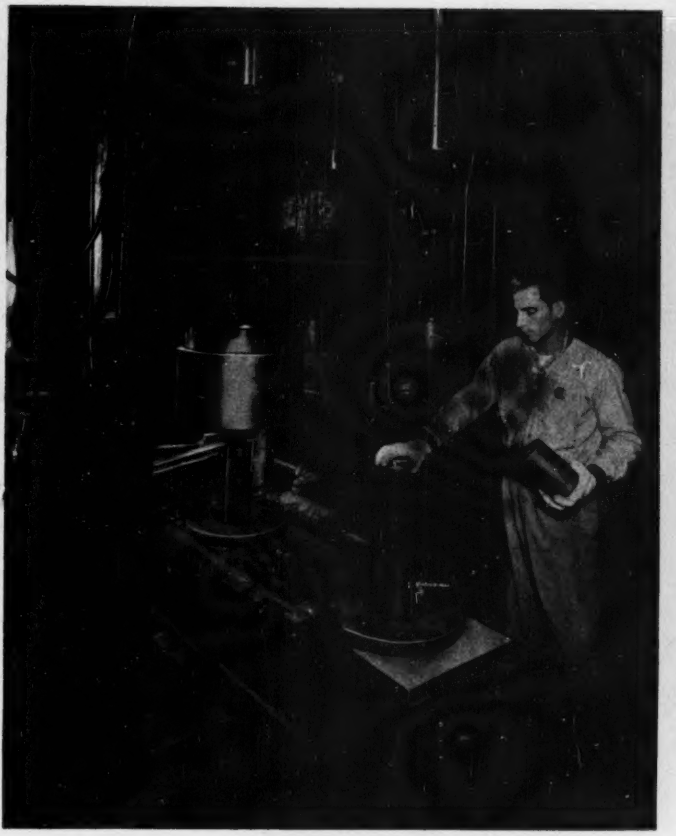


Fig. 5. The shuttle feed of this press keeps nonproductive time at a minimum, it being possible to serve one station while the other station is in working position.

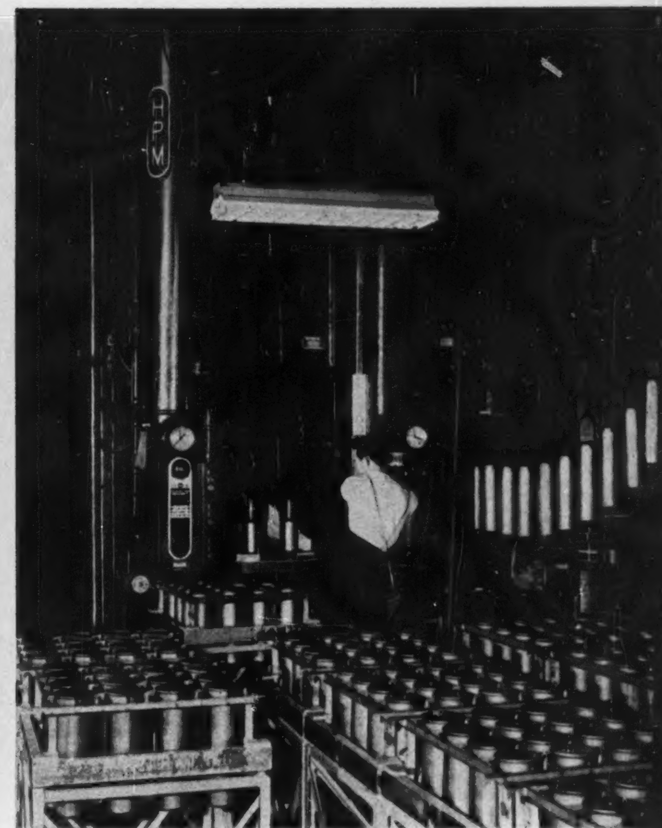


Fig. 6. Final heading of 105-millimeter cartridge cases. Part of the elaborate conveyor system in the plant can be seen at the right of the press.

or serving position. Each station has its own operator. While one station is being unloaded and reloaded, the other is in working position. In the illustration, one of the operators is about to remove a preheaded cartridge case with his right hand. A safety interlock requires that each man has both hands on push-buttons before the press can cycle.

The fourth and final draw, performed on an 80-ton press, produces the required wall thickness. A slight excess of length that is left by this draw is nibbled off as previously. Finish-heading (Fig. 6) follows, and this requires the greatest pressure on each line—a 2500-ton press is needed for the 105-millimeter cases. Following a visual inspection and cleaning, the head is pierced for the primer hole. This completes work in the press area, and the cases are suspended from one of the many overhead conveyors that transport the work about the plant.

After another annealing operation, a Tocco induction unit heat-treats the head. Then the work is conveyed to a bank of electronically controlled New Britain cartridge case lathes, Fig. 7. These machines finish the head to final dimensions, inside and outside, enlarge the primer hole, and face the case off to length.

From these lathes, the cases are passed on to an inspector, seen to the right in the illustration. Next, the head is beaded and then the primer hole is reamed to size on Warner & Swasey special machines. Finally, the mouths of the cases are resized.

Preparatory to painting, the cases are chemically cleaned, dried, and then immersed in a tank for a phenolic resin bath. The cases are in motion while in the tank so that trapped air is bubbled out, assuring complete coverage by the resin. From the bath, the cases are moved over an electrified wire mesh which shakes the resin drops from the ends of the cases, and then they are conveyed to an oven for baking.

After a 100 per cent final inspection by ordnance, shown in the heading illustration, the cases advance to a stamping location where an identification number is rolled into the head. They are unloaded from the stamping machine and packaged for shipment.

Materials-handling in the plant is entirely mechanized. At no time does an operator lift

Fig. 7. Machining to close tolerances on special cartridge case lathes follows the press operations. Completed case is 4.13365 inches in diameter and about 15 inches long.

more than the weight of a single cartridge case. On the press lines, workers can unload the conveyors and load their machines in a single motion. Where cases are to be cleaned or annealed, lift-trucks transport them under the direction of a dispatcher over a two-way radio system.

The plant is equipped with a complete chemical and test laboratory supervised by a metallurgist. Ten cases chosen at random from each lot are slit on a milling machine or a band saw and the segments are subjected to tests (etching, tensile, salt spray) and Rockwell measurements. From the Rockwell readings, graphs are prepared to show hardness recordings on all critical surfaces of the cases, from the primary hole to the wall of the section.

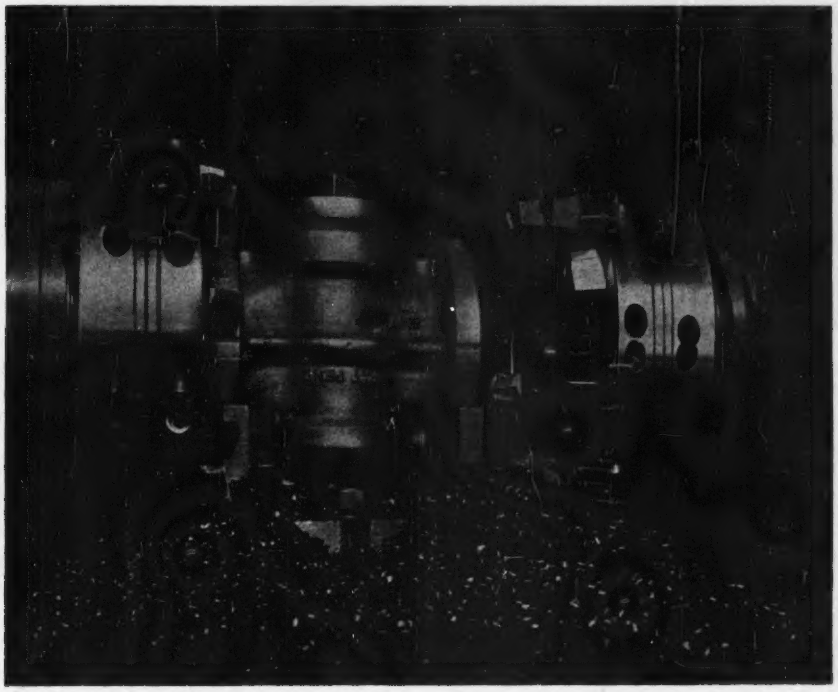
Use of Rare-Earth Elements in Stainless-Steel Melting

New facts concerning the effect of rare-earth metals and compounds, particularly cerium and lanthanum, on the hot workability of austenitic stainless steels have been discovered by C. B. Post, chief metallurgist, and H. O. Beaver, metallurgist, of the Carpenter Steel Co., Reading, Pa. When these elements are added in the form of misch-metal, small amounts of cerium and lanthanum remain in the steel and substantially improve the hot-working properties. Rare-earth oxides leave no trace of cerium and lanthanum in the steel.

It was found that misch-metal additions to high-alloyed austenitic stainless steels can transform them into ductile alloys. Smaller additions of misch-metal to low-alloyed austenitic stainless steels have proved beneficial in further improving their inherent hot workability. This indicates that cerium and lanthanum counteract hot-shortness and improve fluidity and ingot structure.

The metallurgists concluded that rare-earth oxides improve the hot workability of inherently ductile austenitic stainless steels, but not the hot workability of hot-short or hard-to-work grades of austenitic stainless steels. Cerium fluoride additions also improve the hot-workability of austenitic stainless steels containing titanium.

Carbide Tooling Pays Dividends in Machining Valve Castings



Carbide tools have been applied to more than 90 per cent of the operations performed in machining cast-semisteel plugs, bodies, and baseplates for A.C.F. lubricated plug valves

By THOMAS CUNNINGHAM
Machine Shop Superintendent, Valve Division
American Car and Foundry Co., Detroit, Mich.

FULL advantage has been taken of carbide tooling in machining parts for the lubricated plug valves made by the Valve Division of the American Car and Foundry Co. More than 90 per cent of the operations required to machine the plugs, bodies, and baseplates for the valves are performed with carbide tools. This comprehensive program of cutting tool standardization has resulted in the manufacture of improved products at higher production rates and lower costs.

Most of the valve components manufactured by this company (and all of those illustrated and described in this article) are made from semisteel, a high tensile strength, cupola cast iron conforming to A.S.T.M. Specification A-126, Grade B. Although this specification permits a minimum tensile strength of 31,000 pounds per square inch, the semisteel castings employed for the valves have an average tensile strength of 34,500 pounds per square inch and a Brinell hardness between 210 and 230. Chemical composition of the castings is approximately 3.42 per cent carbon, 2.28 per cent silicon, 0.64 per cent manganese, 0.17 per cent phosphorus, 0.11 per cent sulphur, and the balance iron.

Flanges on the plug-valve bodies are faced by means of the straddle-milling set-up shown in Fig. 1. This operation is performed on a Sundstrand duplex-head milling machine that permits

Fig. 1. Duplex milling machine employed to straddle-mill flanges on plug valve bodies. From two to six parts are milled at the same time.

handling from two to six valve bodies at one time—depending upon the valve size. Valve sizes from 1 to 6 inches, having flanges from 4 1/4 to 11 inches in diameter, are accommodated on the one machine. The castings are held in a multiple V-block type fixture, and are manually clamped by means of C-washers, bolts, and nuts.

From 1/8 to 1/4 inch of stock is removed from each flange face on the valve body. The milling heads are equipped with inserted type, carbide-tipped cutters, as shown in the heading illustration. Cutters 8 inches in diameter, each containing eight blades, are employed for valves up to 3 inches in size, and cutters 12 inches in diameter, with twelve blades, are used for 4- to 6-inch valve sizes. The cutters are rotated at a surface speed of 260 feet per minute, and the milling machine table on which the work-pieces are mounted is traversed past the cutters at the rate of 6.7 inches per minute.

Baseplates for two different size valves are machined simultaneously on the Bullard Mult-Au-Matic, eight-spindle, vertical boring mill shown in Fig. 2. The different size baseplates are loaded on successive spindles at the first and second stations. When the castings have been indexed to the third and fourth stations, they are turned, drilled, and chamfered. At the fifth and sixth stations, the baseplates are both rough- and finish-faced. Die-heads are mounted on the vertical tool-slides at the seventh and eighth stations to thread the work-pieces externally. The baseplates are replaced by rough castings, when they return to the first and second stations.

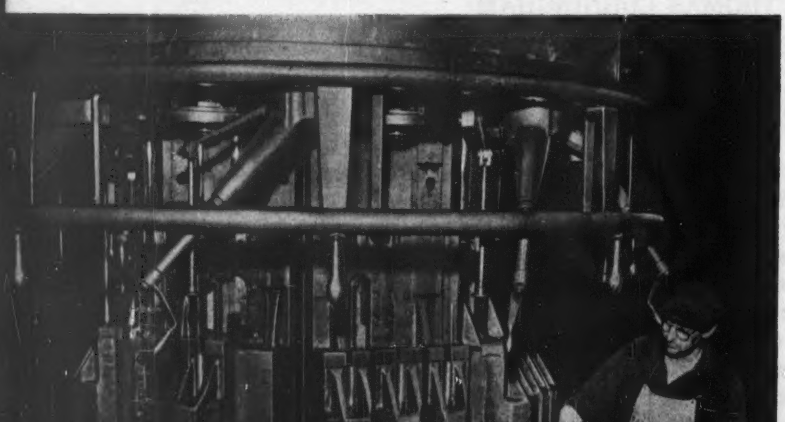


Fig. 2. Baseplates for two sizes of valves are turned, drilled, chamfered, faced, and threaded simultaneously on this eight-spindle vertical boring mill.

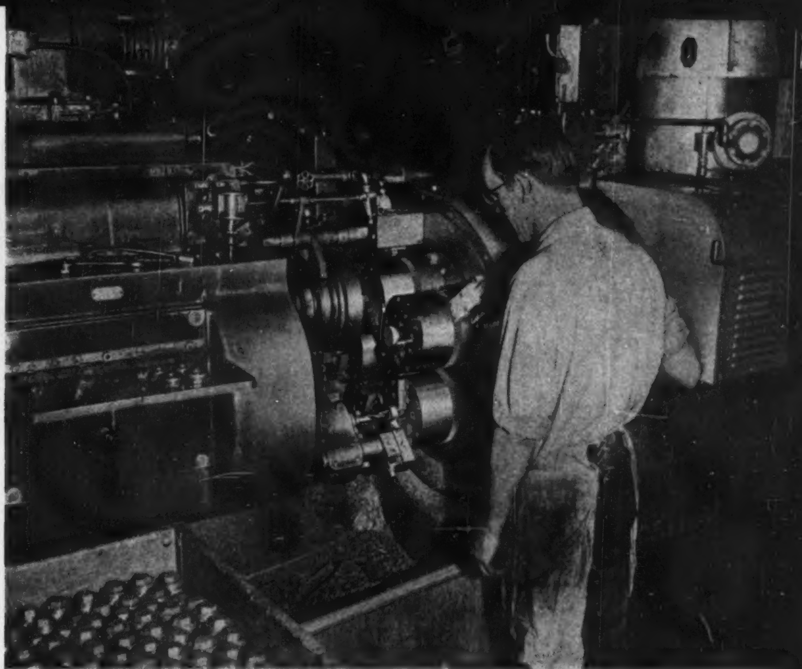


Fig. 3. Five-spindle, automatic chucking machine for producing baseplates employed in valves which vary from 1/2 to 3 inches in size.

All of the tools employed on this multiple-spindle, vertical boring mill are single-point and carbide-tipped, with the exception of the die-heads. Approximately 1/8 inch of stock is removed from the various surfaces, with the baseplates being rotated at 200 feet per minute and the tools fed at the rate of 0.0082 inch per revolution. Although these feeds and speeds are comparatively slow, there would be no advantage to increasing them since the machine cycle time is controlled to obtain an accurate finely finished surface on the baseplates at Stations 5 and 6 of the Mult-Au-Matic.

Smaller size baseplates, for valves 1/2 to 3 inches in size are machined on the Goss & DeLeeuw five-spindle, automatic chucking machine shown in Fig. 3. At the first station, completed baseplates are unloaded, and rough castings are loaded into the chucks. When the workpiece has been indexed to the second station, shown at the bottom, it is drilled and turned. A smaller diameter shoulder is turned and the casting rough-faced at the third station. Finish-facing and chamfering are performed at the fourth station, and the baseplates are externally threaded by a die-head mounted at the fifth station and seen at the top in Fig. 3.

As is the case with the eight-spindle, vertical chucking lathe employed for machining larger baseplates, all of the tools on this five-spindle chucking machine are single-point and carbide-tipped, with the exception of the twist drill and die-head. The castings are rotated at a cutting speed of 200 feet per minute—being automati-

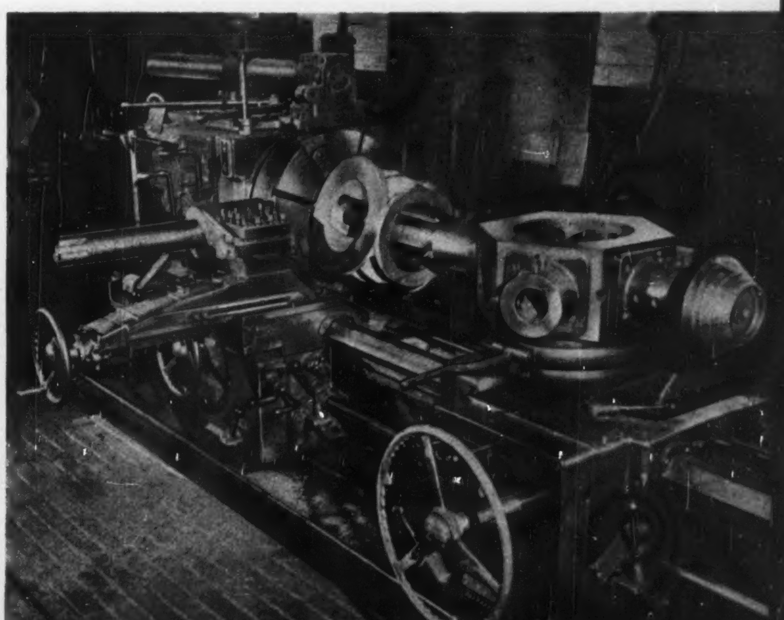
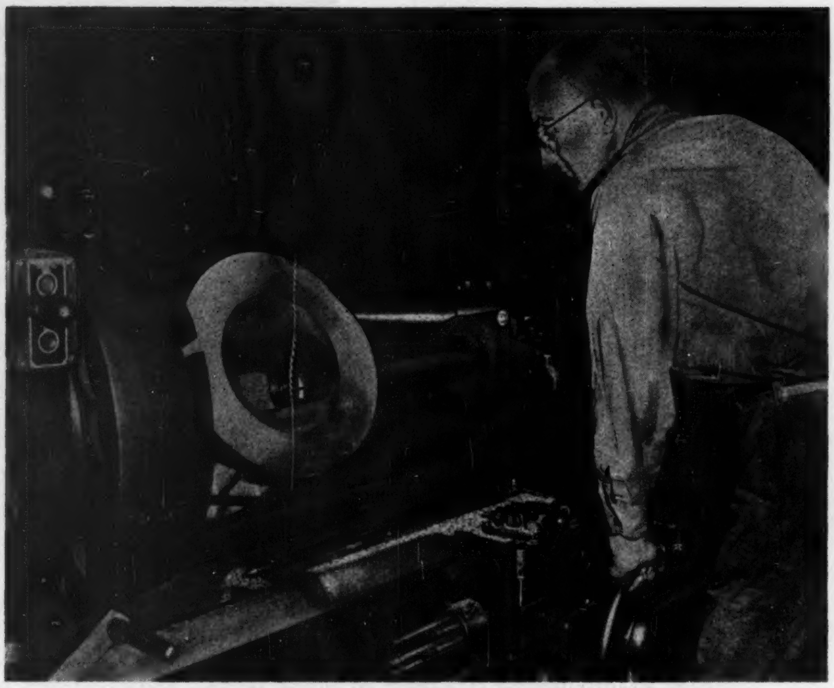


Fig. 4. Turret lathe equipped for performing rough- and finish-boring, facing, and tapping operations on large valve bodies.

Fig. 5. Close-up view of the turret lathe shown in Fig. 4. A carbide tool held in a bar mounted on the cross-slide is employed for finish-boring.



cally stopped as they are indexed to the unloading station—and the tools are fed at the rate of 0.007 inch per revolution. In machining the smaller baseplates (for 1/2- and 1-inch size valves), a production of seventy per hour is obtained. Dimensions of the baseplates are held to 0.001 inch, and a good surface finish is produced to permit metal-to-metal sealing of adjoining surfaces at assembly. Cutting oil is applied at the fifth station to facilitate cutting of the threads.

Large valve bodies are machined on Warner & Swasey turret lathes such as the one shown in Fig. 4. An unusual feature of this set-up is that finish-boring of the bodies is performed with a single-point, carbide-tipped tool held in a boring-bar mounted on the cross-slide of the lathe, as seen in Fig. 5. Rough-boring of the castings is accomplished in the conventional manner with O.K. heads on a bar mounted in the turret. Each O.K. head is equipped with four carbide-tipped boring tools. It has been found that dimensional accuracy, squareness, and alignment of the valve-body bores can be more closely maintained by finishing with a cross-slide mounted tool.

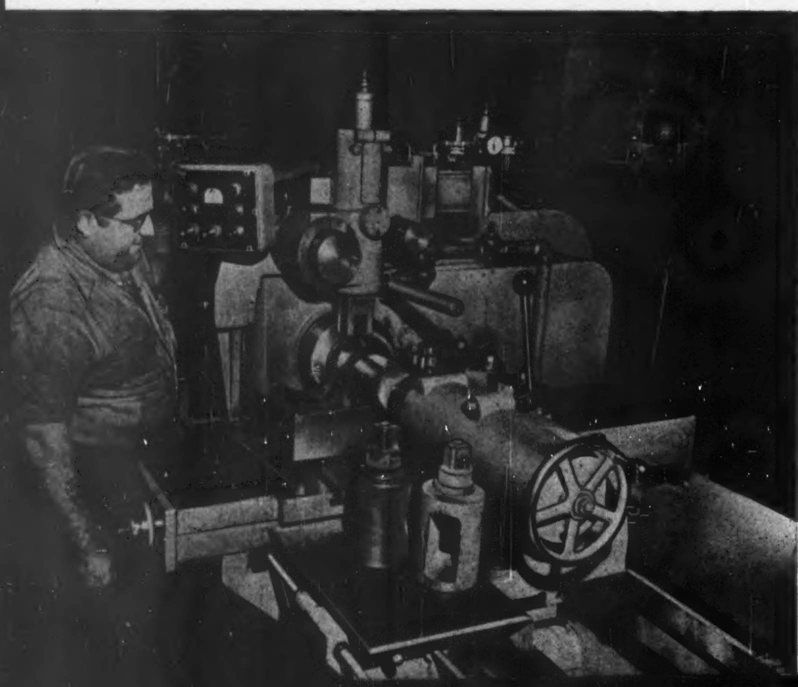


Fig. 6. Valve plugs are turned, grooved, chamfered, and faced on this automatic lathe. Tool on air-operated overhead slide partially turns plug stem.

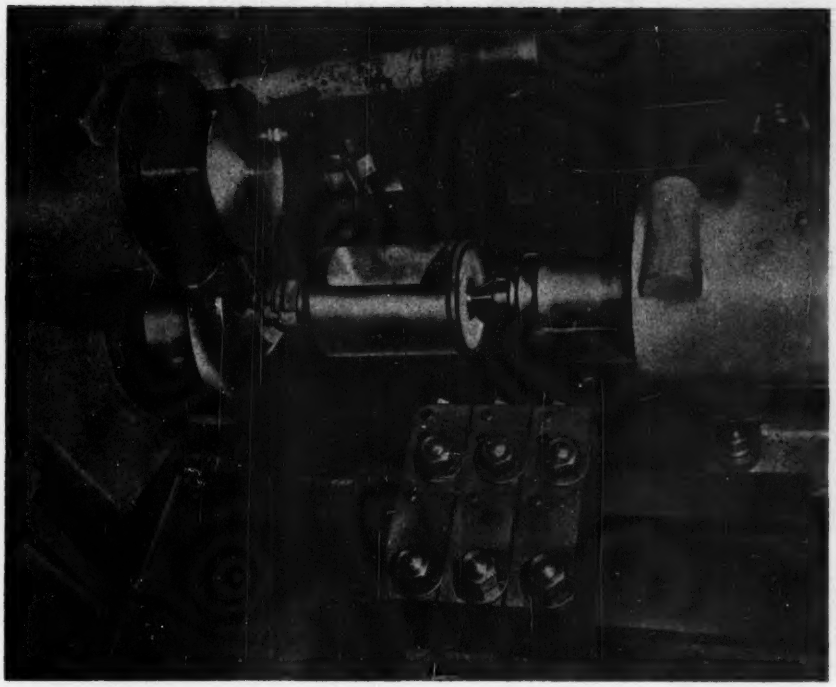


Fig. 7. Close-up view of the tooling area on the automatic lathe shown in Fig. 6. The three carbide tools on the front slide turn the periphery of the valve plug.

Another single-point, carbide-tipped tool is held in the special cross-slide tool-holder for facing the valve bodies. Internal threading of certain castings is accomplished with a tap mounted on the turret of the lathe. Cutting speeds up to 300 feet per minute are employed, and the tools are fed at rates varying from 0.005 to 0.023 inch per revolution—the lower feed rate being used for finish-boring.

Production in machining valve plugs has been increased more than 25 per cent by means of the Sundstrand automatic lathe shown in Fig. 6. Cast-semisteel plugs in thirteen different sizes (up to and including plugs for 12-inch size valves) can be machined on this one lathe. The valve plugs are turned, grooved, chamfered, and faced. The turning operation is somewhat more difficult because interrupted cuts are necessary due to the rectangular port openings through the plugs.

As seen in Fig. 7—a close-up view of the tooling area on the automatic lathe—three tool-blocks are mounted on the front slide, each carrying a tool for turning a portion of the

Fig. 6. Small valve bodies are completely machined with only one chucking of the work on this four-station, indexing, automatic machine.

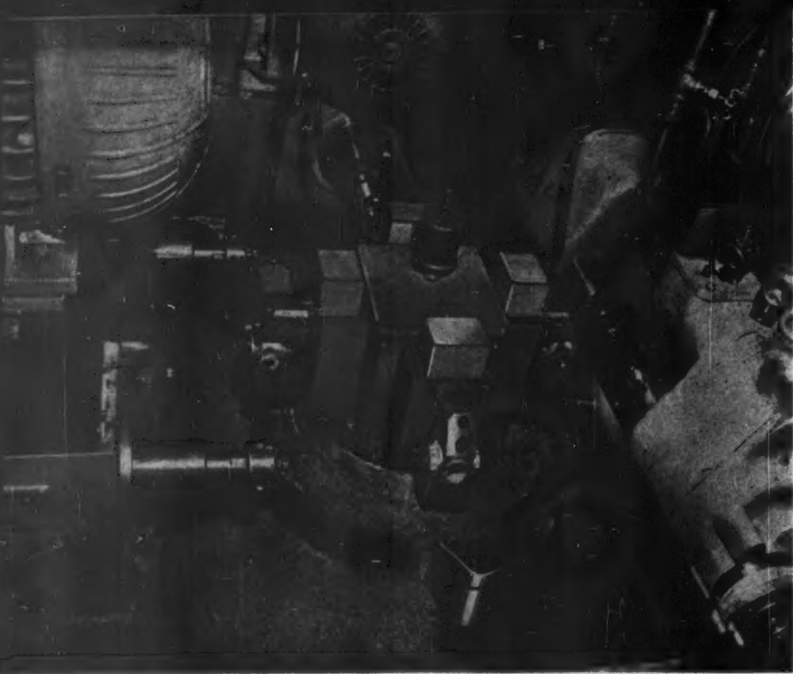


Fig. 9. Boring, chamfering, and facing tools are seen at the left and rear, and pipe taps at the right, for completely machining valve bodies.

periphery. The rear slide of the lathe carries two tool-blocks, the one seen at the left having four tools for facing, chamfering, and partial turning of the stem on one end of the casting; and the other, three tools for facing and chamfering the right-hand end of the work-piece. An unusual feature of this machine is an overhead slide on which one tool is mounted for completing the turning of the stem on the valve plug. This overhead tool-slide is quickly fed down into the turning position by means of an automatic, air-operated mechanism.

In this operation, the valve plug is driven from the square end of the plug, and the opposite end of the plug is supported on a tailstock center. About 1/8 inch of stock is removed from the various surfaces, with the casting rotating at a cutting speed of 200 feet per minute, and the tools fed at the rate of 0.014 inch per revolution. The turning tools on the front slide of the lathe complete their cuts first, and are automatically retracted by means of a cam while the tools mounted on the rear and overhead slides finish their operations. All of the tools are carbide tipped.

All machining operations required on smaller valve bodies (for valves 1/2 to 2 inches in size) are completed with a single chucking of the work on the Goss & DeLeeuw automatic chucking machine shown in Fig. 8. Previously, each operation had to be performed on a separate machine—thus necessitating handling and reloading with resultant increased costs, slower production, and less accuracy. Now, dimensional tolerances

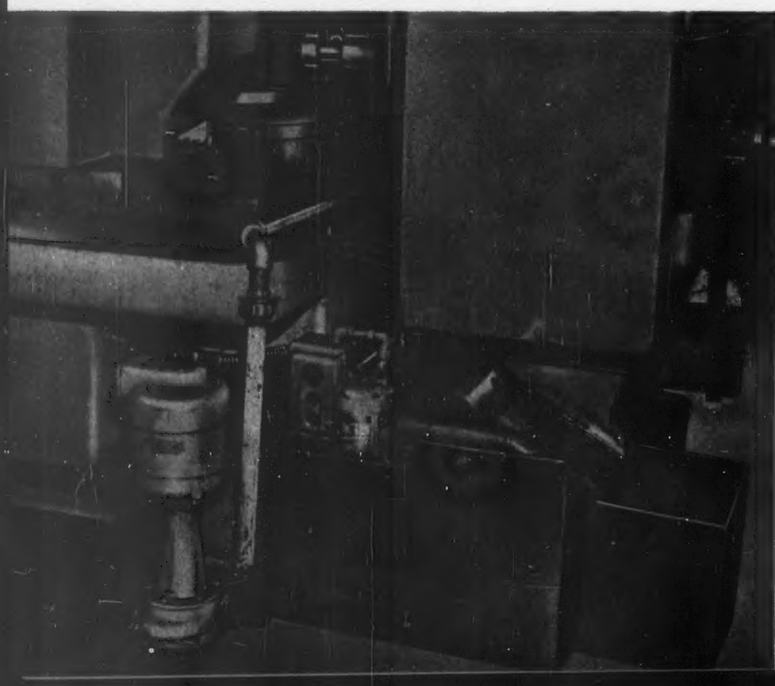


Fig. 10. A magnetic coolant separator is employed on the automatic chucking machine shown in Fig. 8 to remove cast-iron particles from the cutting oil.

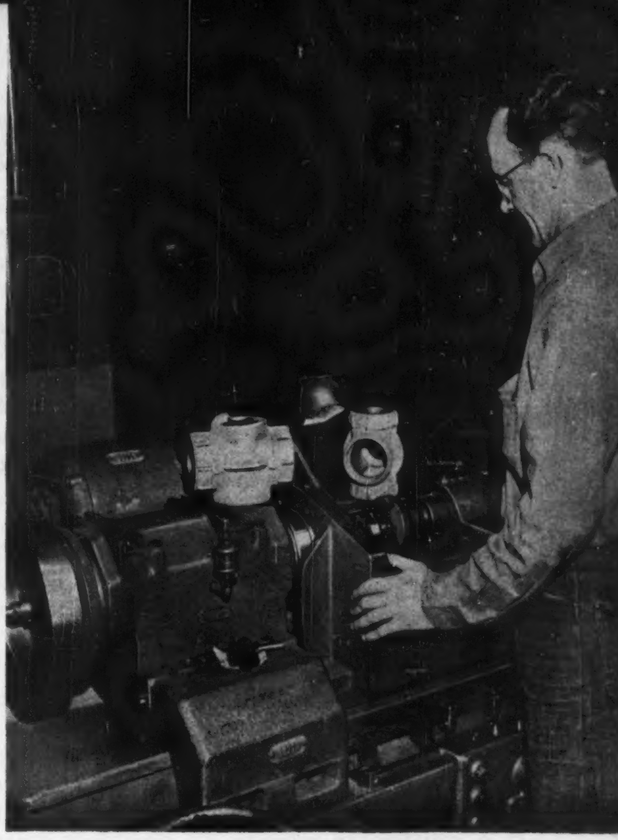


Fig. 11. A cutting speed of 400 feet per minute is used in facing and finish-boring cast-semisteel valve bodies on this precision boring machine.

are held to 0.001 inch, alignment of the threads at opposite ends of the bodies is practically perfect, and a production of forty-five parts per hour is obtained from a single machine.

Completed valve bodies are unloaded and rough castings are loaded at the first station of the automatic chucking machine. Before the work-piece is indexed, the tools shown at the lower left in Fig. 9 are advanced to bore, chamfer, and face one pipe end of the body. When the casting has been indexed to the second station, the circular form tool seen at the left center rough-bores the valve body. At the third station, the tools at the left rear bore, chamfer, and face the other pipe end of the body. Simultaneously, the tools at the rear semi-finish bore all diameters and face the baseplate end. The three taps seen at the right cut the internal threads in both pipe ends and the baseplate end when the valve body has been indexed to the fourth station. All of the tools, with the exception of the taps, are carbide.

From 3/32 to 1/8 inch of stock is removed from the various surfaces of the valve bodies in these operations. The tools are rotated at a cutting speed of 200 feet per minute and fed 0.010 inch per revolution. While cast iron and semisteel are usually machined dry, this operation is performed with a cutting oil. With a cutting oil, it was found that chatter was practically eliminated and tool life was increased —up to 10,000 work-pieces before resharpening is necessary. A sulphurized, fatty oil base (Swan-Finch Cadrex No. 1) is mixed with a cutting oil (Gulf No. 372) in the ratio of 1 to 8 for this application. This oil has an anti-welding characteristic to prevent the chips from becoming "welded" to the tools or boring-bars. This is necessary because of the small clearance between the bars and bores in the work that has been specified to increase accuracy and minimize chatter.

Since minute cast-iron particles in the oil would serve as a lapping compound, thus producing inaccurate work-pieces and shortening tool life, the automatic chucking machine is equipped with a Barnesdril magnetic coolant separator, Fig. 10. The cutting oil flows directly into the separator from the machine. A cylindrical drum made up of several Alnico magnets rotates in a direction opposite to that in which the cutting oil flows. The cast-iron particles are attracted to the magnets, and are scraped from the drum into a removable container seen at the lower right. The clean cutting oil is pumped back into the machine. This system has improved the surface finish produced on the valve bodies, and increased the life of the tools and cutting oil.

Facing and finish-boring of smaller valve bodies (for valves 3/4 to 4 inches in size) are accomplished on the Ex-Cell-O precision boring machine shown in Fig. 11. About 0.030 inch of stock is removed from the bores, and 0.003 to 0.005 inch from the face. The facing tool is set in the bar ahead of the boring tool, with the two carbide-tipped tools being diametrically opposed in the bar. The boring-bar is supported by a spring-loaded tailstock center during facing, to insure accurate alignment between the face and bore of the valve bodies and to eliminate chatter while facing. A cutting speed of 400 feet per minute is employed, and the tools are fed at the rate of 0.005 inch per revolution.

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Welding Preheat Temperature Calculator

A calculator based on the slide-rule principle for determining preheat temperatures required in welding hardenable steels has been brought up to date by the Lincoln Electric Co., Cleveland, Ohio. Preheats can be calculated in simple steps that are based on chemical analysis and steel thicknesses from 1/2 to 10 inches. This calculator is available at nominal cost.

Adequate Detail Drawings— A Key to Successful Production

How can all of the information needed to control the size and shape of mass-produced components be clearly specified on detail drawings? In this third of a series of articles on dimensions and tolerances for mass production, the author analyzes the factors to be considered in attaining this objective.

By EARLE BUCKINGHAM
Professor of Mechanical Engineering
Massachusetts Institute of Technology

THE essential requirement of an adequate detail drawing is that it should contain all of the necessary dimensional information for the production of a component that will assemble in its proper place and function in a satisfactory manner. To provide a detail drawing that is adequate, the designer must set down all of the information needed to control the size and shape of the component and the position of its features in such a way that it cannot be misinterpreted.

There are two obstacles to achieving this end that concern us here. One is the frequent lack of knowledge of and failure to appreciate the difficulties involved in controlling conditions of position, contour, and symmetry; and the other is the present inadequacies and ambiguities of the drawing language.

As pointed out in a British Admiralty Service Report—Drafting Room Practice in Relation to Interchangeable Components—by C. A. Gladman, few attempts have been made to help designers to reason along logical practical lines and to establish fundamental principles and effective methods by which he can solve the various types of dimensional problems that he encounters. This is particularly true in relation to conditions of position and symmetry, despite the fact that for interchangeability, the control of position, symmetry, and concentricity is as important as the control of elementary dimensions of size. Hitherto, the lack of knowledge or appreciation in the design stage has led directly to extreme difficulties in practice, especially in providing satisfactory position gages. These have often been a bottleneck in production owing to the close tolerances required. These difficulties could have been reduced, if not entirely eliminated, in many cases were the practical aspects sufficiently appreciated and understood.

At present, this report goes on to point out, even if there existed a logical basis for determining the dimensions and existing tolerances for components, it is doubtful whether solutions could be stated on the drawings with complete satisfaction because of the inadequacies of the drawing language. Tolerances essential for interchangeability have been omitted in the past since there was no ready method of indicating them, and drawings could often be interpreted in more than one way. When drawings contain incomplete and ambiguous information, it is left to the production and inspection departments to make an additional analysis of the complete design and to determine for themselves the variations which can be permitted. This is a laborious and uncertain process as it is unlikely that the production personnel will have sufficient knowledge or available information to assess the tolerances satisfactorily. Moreover, it is not their responsibility to do so. Interchangeability and correct functioning under such conditions become largely a matter of chance, instead of a carefully planned scheme.

It should be evident, then, that the task of dimensioning the detail drawings of the components for mass production is not a job for the office boy or an apprentice draftsman. The best production engineering talent in the organization will find full scope for the application of all the knowledge and experience available in this task. There is probably no other place in the organization where so much money can be saved by careful attention to detail, and there is certainly no other place where so much money can be wasted by carelessness and ignorance.

Dimensioning Detail Drawings

Establishing the Design Sizes—The first step toward dimensioning a detail drawing is to enter on it the sizes that would be used if it were possible to produce identical parts to exact sizes. These are the *design sizes* and they are usually the *maximum metal sizes* in the great majority of cases. The design sizes of mating features are, in each case, established so that the proper allowance for the kind of fit required will result. In setting down the design sizes, the most important functional surfaces should be considered first and then the others in the order of their relative importance.

Detail drawings should contain all dimensional information necessary for the production of components that will assemble and function properly. Such dimensional information is, in effect, a statement of the inspection gage requirements, whether or not the facilities to be used are standard measuring devices or specially constructed gages.

Dimensioning Functional Surfaces and Features—Dimensions should be given between those surfaces which must be held in a specific relationship to each other. This applies particularly to all functional surfaces and to other functional features, especially when requirements of position exist. This practice also establishes the correct datum for machining and gaging. The majority of the dimensions are relatively unimportant in this respect. Some common datum should be established on each component for such dimensions to simplify the problems of machining and gaging.

Every feature of a part must be located definitely to fix its position. Every pair of mating and operating surfaces must be located with adequate operating allowances. After the requirements of location are met, all other surfaces must have liberal clearances. Clearances are the most important part of the Production Design. That product which permits the most liberal clearances will be the best and cheapest to manufacture on an interchangeable basis.

Selection of Datum Surfaces—Chains of dimensions with tolerances that build up large cumulative variations must be avoided wherever possible. Suitable datum surfaces must be selected and the positions of the several features must be located from as few different datum surfaces on the same component as possible. One of the purposes of the Production Design is to arrange the parts of the mechanism so as to have the fewest possible datum surfaces. In other words, the distance between any two points or surfaces must be dimensioned with tolerances from only one datum.

The datum surface is used to locate the component while any specified feature is being machined. The selection of these datum surfaces involves consideration of both the assembly and the operation of the component as well as its location in chuck, jig, or fixture when it is machined. Thoughtlessness, here, can cause much trouble and add needless expense in the manufacture of the component.

Avoiding Duplicate Dimensions—Dimensions between the same points or for the size of the same features should not be duplicated on different views of the same part. Duplication of dimensions often causes much trouble because of changes which may be made in one place and not in all of the others. It is less trouble to search a drawing to find a specific dimension than it is to have such a dimension repeated, and perhaps erroneously so.

Keeping Detail Drawings Up to Date—Many changes are usually made in the course of continued production and the Production Design is never completely finished so long as the article remains in production. The probable need and the real value of such revisions should be recognized from the very start and provision should be made to make them promptly. Of course, any proposed change must be carefully verified to make sure that it will facilitate production without any detrimental effect on the functioning of the product.

The original purpose of the detail drawing is to give the essential dimensional information needed to start the production of a new article. After production has begun, however, the detail drawing has a future function. It must provide a place on which to record many of the lessons learned by actual experience in production. Such a drawing must be revised continually to keep abreast of the practice in the shop. Only in this manner can each new product receive the full benefit of the experience gained in the production of earlier designs.

Summary of Detail Drawing Requirements—The requirements of detail drawings have been summarized in the Gladman Report under the following basic principles:

1. The requirements relating to interchangeability should be determined by the following considerations as they may apply:

(a) *Service conditions, namely, maintenance and repairs.*

One of the most important factors bearing upon interchangeability requirements of the components of a unit is that comprised in the

service conditions. Obviously, these conditions will vary in the broad field of engineering practice. Some units in use may require frequent servicing and replacement of their component parts because of wear or damage, since it would be desirable to have every component completely interchangeable in every unit. On the other hand, there are units which may be expected to function satisfactorily throughout their working life without attention or replacement. Hence, it would be uneconomical to insist upon these components being strictly interchangeable, since the essential requirement is for the unit itself to function correctly and to assemble with the main product. In such cases, the unit would need to be interchangeable with all other units, but the components of one unit would not need to be interchangeable with those of another. Obviously, in practice, there will be intermediate cases in which service conditions will require strict interchangeability of only a limited number of the components that make up the unit.

(b) *Economy of manufacture and inspection.* Economical considerations relating to manufacture and inspection often dictate the policy to be adopted in relation to the requirements of interchangeability. For instance, in order to maintain an assembly condition, perhaps with regard to the position or concentricity of features on components, it may be more practical to assemble the components together with machining allowances, and then to machine the appropriate features to the finished sizes at one setting. The assembly then may be made interchangeable, although the components within the assembly need not necessarily be so.

It should also be borne in mind that interchangeability necessarily requires that all manufacturers work to the same legal standard of length for the dimensions and positions of features on each mating component. In those cases where functioning demands fine clearances and tolerances, this is sometimes impractical, especially with work that is positioned and the corresponding position gages. These difficulties can often be overcome by adopting special methods—such as the use of a master system or the adjustment of the tooling equipment for one component relative to that of the other. Mating components made in any one factory will then be locally interchangeable but will not necessarily interchange with those made in any other factory. It is also true that the greater the number of interchangeable components within an assembly, the greater will be the cost of the gages required to inspect that assembly.

Difficulty is sometimes experienced when suitable functioning tests for a unit are required—tests which will adequately prove that the unit will be satisfactory in service. Often, practical considerations limit the scope or completeness of such tests; dimensional variations of features on components may not adversely affect the performance of the unit under its limited test, and yet may seriously impair its functioning under service conditions. When this is the case, the critical features must be checked for dimensions; and they must be regarded as strictly interchangeable, despite the fact that once assembled they may never require replacement.

Conditions such as the foregoing have lead to the division of interchangeable manufacturing into two broad categories as follows:

(1) *Universal Interchangeable Manufacture,* in which parts made in different factories or organizations are required to be mutually interchangeable.

(2) *Local Interchangeable Manufacture,* in which only parts made in the same factory or organization need to be interchangeable.

2. Standard sizes and parts should be used wherever possible.

3. The features of the details of an assembly should be carefully studied and design sizes should first be assigned to those dimensions which affect either assembly or functioning, or both. (The systematic analysis involved in following this principle will automatically establish the functioning datum surfaces.)

4. Where variations from the desired assembly or functioning requirements can be permitted only in one direction, appropriate unilateral tolerances should be assigned to the relevant design sizes or dimensions. Where variations can be permitted in both directions, bilateral tolerances should be used.

5. The datum surfaces established from functional considerations should be examined for their suitability for economical manufacture and inspection. If unsuitable, they must be replaced.

6. Tolerances should be so assigned that no dimension is subject to conflicting limits.

7. Fits between mating parts should be arranged, in general, on the hole basis. The shaft basis should be used in special cases where the hole basis is not suitable.

8. Clearances or interferences should be established with due regard to the effect of the tolerances on gages and the extent to which the gages are permitted to wear.

9. The geometric lay-out and the method of setting tolerances of designs for complex work should be scrutinized, and if necessary modified,

in the light of practical manufacturing and inspection requirements.

10. Tolerances should be assigned to features for position, concentricity, alignment, squareness, flatness, and parallelism, when the control of these elements is important to correct assembly or functioning, or both.

11. Tolerances should be as wide as is consistent with satisfactory functioning and should be examined carefully to insure that no special difficulties in manufacture or inspection have been imposed without real functional necessity.

Specifying and Interpreting Tolerances

Necessity for Tolerances—Since tolerances are necessary evils, it would be much better and simpler if they could be eliminated. They are needed only because of the inability of the present production processes to produce identical parts. Every effort, therefore, must be made to express tolerances in a clear and simple manner so as to minimize trouble and confusion.

Kinds of Tolerances—Tolerances must be applied to meet the four following conditions:

1. *Conditions of size or bulk alone.* Many of the dimensions define elementary surfaces where the problem is relatively simple except for the extent of the tolerances.

2. *Conditions of form.* These define composite surfaces where several interrelated dimensions are needed to define the form. This problem involves the application of one or more general tolerances to a group of constructional dimensions. Here, certain arbitrary interpretations with regard to their translation into inspection gage requirements will be needed. In addition, there are several types of geometrical forms that require special treatment.

3. *Conditions of position.* These include conditions of alignment, concentricity, and symmetry, as well as spacing. Conditions of position also involve composite surfaces. Besides, they involve certain arbitrary interpretations concerning their translation into inspection gages.

4. *Conditions of Operation or Functioning.* These require specific designs of functional gages.

Tolerances Include All Permissible Variations—The tolerances which are specified include all variations that can be permitted because of variations in the size of the gages, tools, performance of metal-working processes, and the like. One practice sometimes followed is to assign some fixed percentage of the tolerances on the work to the gages and cutting tools. This can be done in many cases where the tolerances are of appreciable extent. When conditions are critical and the permissible tolerances are small, this practice may not be practicable. Under such conditions, one does the best that one can, and if the final results are not satisfactory, either the equipment or the operating technique must be improved or the Production Design itself must be revised to make production feasible.

How Tolerances Are Selected—The first completed draft of the detail drawings represents the opinions (or first best guesses) of a relatively small group of individuals as to what will be needed for the finished product. In case of doubt, the first tolerances assigned are often made as small as it is possible to maintain them in actual production. Many of the original tolerances are later increased when the difficulties of manufacture prove to be severe and larger tolerances can be used without detriment to the functioning of the component in actual service. The practice of making manufacturing models from the first draft of the Production Design, before actual production is begun, usually discloses many of these conditions.

The extent of the tolerances should be as great as the satisfactory functioning of the product will permit. Past practice on similar products, as recorded on revised and up-to-date detail drawings, is of the greatest help in this work. Selections can also be made from available limit systems. For critical conditions, however, the functional operation of the product is the determining factor. This objective must be obtained whether or not the tolerances are the same as in any limit system or on any previous example.

Relation of Tolerances to Inspection Gages—As previously stated, the dimensional information on the detail drawing specifies the requirements of the inspection gages. If additional information is needed by the shop to facilitate the manufacture of the component, this information should be given only on the operation drawing. It has already been noted that when a master gage has been verified and accepted, its actual size and form supersedes all the corresponding dimensional information on the detail drawing. This is also true for the inspection gage. The dimensional information on the detail drawing gives the limiting sizes for the inspection gages. Any condition that these gages will accept is, therefore, in accordance with the dimensional information on these drawings, even though there may seem to be technical violations of strict geometrical interpretations.

A change in the general design of a gage may necessitate altering manufacturing methods in order to meet the requirements of the new gage. Once inspection gages have been accepted, a re-

vision in their design is equivalent to a change in the actual dimensional specifications of the part in question. Any other interpretations will lead to endless argument. Hence, when detail drawings are dimensioned, the permissible conditions of the components must be studied in the light of those conditions that will be acceptable to the gage to be used. Once production has begun, the work is manufactured to suit the gages, and adjustments and corrections to tools and set-up are made only as indicated by the gages.

As noted before, any condition acceptable to the gages will persist even if it involves a technical violation of the strict geometry of the detail drawing. This only emphasizes the necessity of making these drawings complete and correct, without ambiguity. This last requirement, in turn, makes it of the utmost importance that all who use these detail drawings interpret them in exactly the same manner. It is an unfortunate condition that even today the same detail drawing is interpreted in a dozen different ways in as many different shops—or even in different ways by different people in the same shop.

Where Tolerances Are Not Specified—Some dimensions on a detail drawing do not require tolerances. Among such "untoleranced" dimensions are the constructional and calculated ones. In addition, other dimensions of minor importance may not have been considered in respect to their extreme limits of permissible variation. Pressure of time or other reasons may prevent such features from receiving any attention at all. However, absence of a tolerance does not mean that no variation at all is permitted on such features. It simply means that, ordinarily, such features need not be checked. When questions arise in production that can best be answered by assigning a tolerance to such a neglected feature, then one should be assigned. In other words, every effort must be made to complete all essentials and, if necessary, to let the non-essentials take care of themselves. Furthermore, no limiting condition should ever be specified that is not going to be actually inspected during the course of manufacture.

In many cases, if a sharp corner must be removed, a simple note such as "Break Corners" may be adequate. If the results obtained are not satisfactory, this can be amended to read: "Break Corners, 0.062 MAX." In other words, only one limiting value of the dimension may be necessary in some cases. This may be either the maximum or the minimum size and should be so specified. Such a feature would then be inspected to insure that it does not exceed the specified maximum or minimum value.

Tolerances for Castings and Forgings—When components are made from castings or forgings, there should be separate pattern or forging drawings. These drawings are primarily for the use of the patternmaker or diemaker. In effect, items such as patterns are manufacturing facilities and not a manufactured product. They are made in small quantities by skilled patternmakers or diemakers. Tolerances are seldom needed here. Any tolerances on these drawings are for the guidance of the patternmaker or diemaker, and not for the casting or forging.

Usually the castings and forgings made from these facilities can have quite large tolerances, at least as compared with those for machined surfaces. In most cases, a common tolerance for the majority of the dimensions can be specified on the purchase order to the supplier. A few of the dimensions may be more important and critical than the others, and these may have their specific variations stated on the purchase order. The design size or position of any cast or forged surface should be shown on the detail drawing as a constructional dimension when needed, but the casting or forging tolerance should not be repeated here.

Methods of Denoting Tolerances—Two different methods for denoting tolerances or limiting sizes are now in general use. One method gives the design size followed by the tolerance—for example, *2.248 — .004*. If it is a unilateral tolerance, there is no need to include "plus zero." If it is a bilateral tolerance, a plus and minus sign is used before the tolerance. In effect, the specific notation shown says that the size should be 2.248 inches if it were possible to make it of exact size. It must not be any larger, but it can be smaller by an amount not greater than four-thousandths inch. This method of expressing the tolerances is widely followed when the inspection equipment consists largely of comparators and standard measuring instruments.

The other method specifies the two limits of size, the one written above the other: $\frac{2.248}{2.244}$.

In effect, this notation says that the size must not be larger than 2.248 inches nor smaller than 2.244 inches. With unilateral tolerances, some study may be needed to identify the design size if no fixed practice is adopted as to its position in this notation. If the first guess as to the permissible extent of the tolerances (the greatest that the functioning of the product will permit) were always the final one, and no changes were ever needed, it would not matter in what order these limits of size were given. But if the detail drawings are to be kept up to date with the

course of actual production in the shop, then changes are the rule and not the exception, and a standard method of identifying the design size is desirable.

If the first draft of the Production Design has been reasonably adequate and the detail drawings have been dimensioned with reasonable care, then most of these changes will be in the extent of the tolerances. Many of the original tolerances will be found to be too exacting for economical manufacture and unnecessarily close as regards the functioning of the product. These will be increased. A very few may be found to be too great for the correct functioning of the product. These must be reduced. If the limits of size are entered in a random manner, with the design size sometimes at the top and sometimes at the bottom, confusion results and the design size will be inadvertently changed at times instead of the other limit. The top figure is the one the eye usually catches first, and this should always be the design size. The expression of the limiting sizes is widely followed when a complete equipment of special gages is provided for the inspection.

The need of clear and definite specification of tolerance for the various sizes and geometrical relationships of every feature of every component introduces at times perplexing problems. They must be solved so that the inspection gages that result from the requirement expressed on the detail drawings will insure components that will assemble and operate correctly.

Where a Functional Gage is Needed—In some cases, the requirements cannot be expressed adequately by the dimensions alone. Many such problems can be solved best and most simply by the detailed specification of the test or gage that will be used to check the specific condition. Such a gage is called a *functional* gage. Its size, form, and construction are dictated by the conditions of operation and assembly of two or more details rather than deduced directly from the dimensional specifications of the single detail drawing. Such conditions are a challenge to the ingenuity of the designer to devise a simple test that will insure the required results. If the functional gage is a simple one, it may be drawn directly on the detail drawing. If it is a complex one, it is drawn on a separate drawing with a direct reference to it on the detail drawing. In either case, it becomes an integral part of the dimensional specifications of the component. In other words, if the dimensional specifications of the individual part itself do not define the gage required, then its design must be shown directly. In all cases, the information on the detail drawing must define the inspection gages.

Summary of Principles Relating to Dimensions and Tolerances—The actual dimensioning of the features of the components on the detail drawings and the application of tolerances to these dimensions will be considered in subsequent articles. Following is a summary of the principles upon which they are based:

1. No tolerance should ever be given unless it is to be actually tested or gaged in the course of manufacture.

2. Limiting dimensions give the extreme sizes of the inspection gages. All limiting dimensions or other limiting conditions must be translated into specific inspection gages or test procedures.

3. Three different kinds of dimensions are needed on the detail drawings of the components. They are as follows:

(a) *Constructional Dimensions.* These are needed to define geometrical relations, and no tolerances are ever given directly on such constructional dimensions. If their constructional nature is not clearly evident, they should be followed by the letters *CONS.*

(b) *Calculated Dimensions.* These may be needed, at times, to establish some basic conditions from which some other dimensions are established. No tolerances are ever given on such calculated dimensions. In all cases they should be followed by the letters *CALC.*

(c) *Limiting Dimensions.* These define machined or finished surfaces essential to the assembly and operation of the product. The limiting sizes, or the design size with a tolerance, must always be specified. The conditions so established are translated into definite inspection procedures.

4. The limiting dimensions themselves must meet four different conditions, as follows:

(a) Conditions of size or bulk.
(b) Conditions of form.
(c) Conditions of position.
(d) Conditions of operation or functioning.

Consideration will next be given to the methods of determining and expressing the dimensions and tolerances for the four different conditions of limiting dimensions and their translation into definite inspection gages, starting with the conditions of size or bulk.

* * *

The United States aircraft industry today virtually has completed its scheduled expansion under the Government's emergency program. Aircraft plants throughout the nation, supported by some 61,000 subcontractors and suppliers, are producing military planes at the rate of about 1000 each month.

Cold-Heading and Grinding Valve Push-Rods for Buick Engines

A ball is upset simultaneously at both ends of the valve push-rods, after which the spherical surfaces are flame-hardened and ground

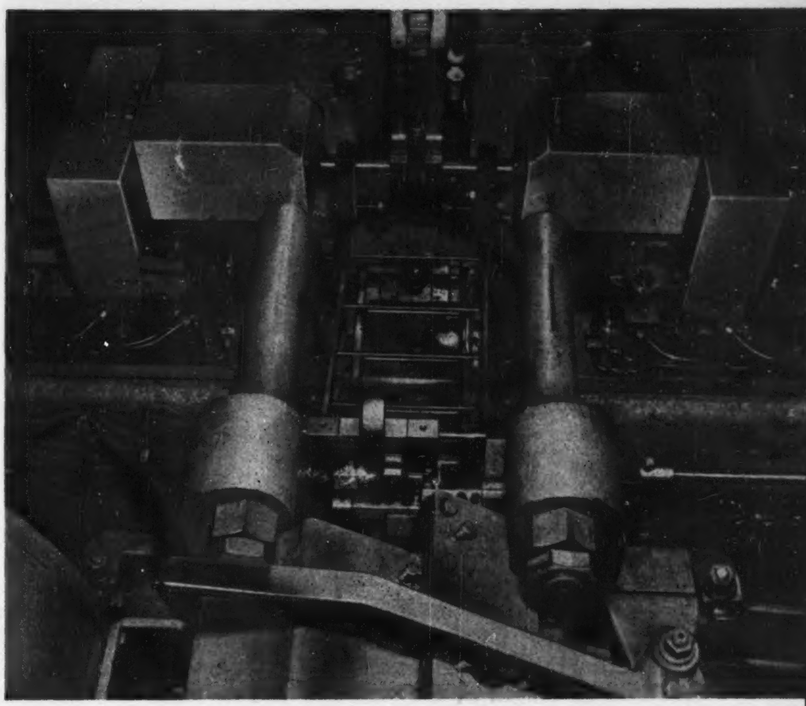
By HERBERT CHASE

UNTIL recently, the accepted method of making push-rods for overhead valve automobile engines was to turn end fittings in automatic screw machines and insert these fittings into tubes cut to length. When Buick engineers designed the new V-8 engine, however, it was decided to make the push-rods in one piece by upsetting the ends of small-diameter rods cut from straightened coiled steel wire. This production method is faster than the process previously employed and, since there is only one piece instead of three, it also effects handling economies. In addition, assembly costs previously involved in obtaining the final part are eliminated.

The valve push-rods are produced from coils of 9/32-inch hot-drawn, pickled, and lime-coated S A E 1062 steel wire. This stock is converted

Fig. 1. High-carbon steel wire is fed through a drawing die and into a double-end cold header which upsets a ball on each end of push-rod blanks cut from the wire.

Fig. 2. The push-rod blanks are fed transversely from the cut-off attachment to fingers that lower them into the upsetting position.



into cold-drawn rods by being passed through drawing dies that reduce the diameter to 0.255 inch. The operation is performed by the Ajax-Hogue wire drawing machine seen in Fig. 1 installed in line with a Waterbury Farrel double-end cold-heading machine.

The wire is straightened as it is fed through the drawing dies. From the drawing dies the wire goes directly into the heading machine through a tube that leads to a shearing attachment which cuts off the blanks to length. In Fig. 2, the cut-off blanks are seen being transferred from the shearing attachment to two overhead fingers which pick up each blank individually and lower it into a clamping die. The blank, held securely, is then immediately struck on both ends by heading dies.

Two blows are struck on both ends of the rod to form the ball on each end. In the first blow, a portion of the blank is upset a short distance from the end to partially form the ball-like shape. After this blow, the heading dies retract and are elevated to bring the finishing cavity in each die into line with the work. The second blow is then struck simultaneously on each end to head the ball to its final upset size and shape. When the dies retract after the second blow, they are lowered to their original position, ready again to make the first blows on another blank. The clamping die next opens, and the forged push-rod is ejected. This leaves the clamping die ready for reloading at the start of the next machine cycle.

Adjustments are so made that the blows imparted on the upset ends of the work displace the same volume of metal. Hence, the two ends are duplicates and the over-all length is held within specific limits. There is, of course, stock allowance for subsequent machining. Upsetting produces ball ends 3/8 inch in maximum diameter, which leaves sufficient stock for grinding the ends to true spherical surfaces that will fit mating sockets when the push-rods are assembled into an engine.

Although upsetting work hardens the metal, the hardness must be increased by heat-treating. This is done with the Cincinnati Flamatic equipment shown in Fig. 3. The rods are placed on an inclined magazine as illustrated, from which they feed automatically into position between teeth on end plates of a horizontal drum-like fixture that rotates slowly.

After the rods have been carried past the highest point of the drum, both ends of each rod enter heating zones where jets of burning propane gas heat the rod ends to a quenching temperature. While the rods are in the heating zones, a belt that moves in contact with the rods keeps them revolving on their own axes so that the ball ends are heated uniformly all around the spherical surfaces. The drum speed and the gas combustion are so adjusted that both ends of each rod attain the quenching temperature by the time that the rod reaches the bottom of the drum. There the rods clear the belt and drop into a quenching tank. The operation results in a hardness of from 60 to 62 Rockwell C on the ball ends.

After the push-rods leave the quenching tank, they are transferred to Besly grinding machines of the type shown in Fig. 4. On these machines the rods are automatically fed down a magazine, as illustrated, into V-shaped notches provided around the periphery of a revolving drum. The rods are prevented from falling off this drum by a cable that runs over sheaves located above and to the rear of the drum.

At the back of the drum, the rods come into contact with grinding wheels which are shaped to rough-grind the ball ends and a neck 15/16 inch long to the inside of each ball. The rods

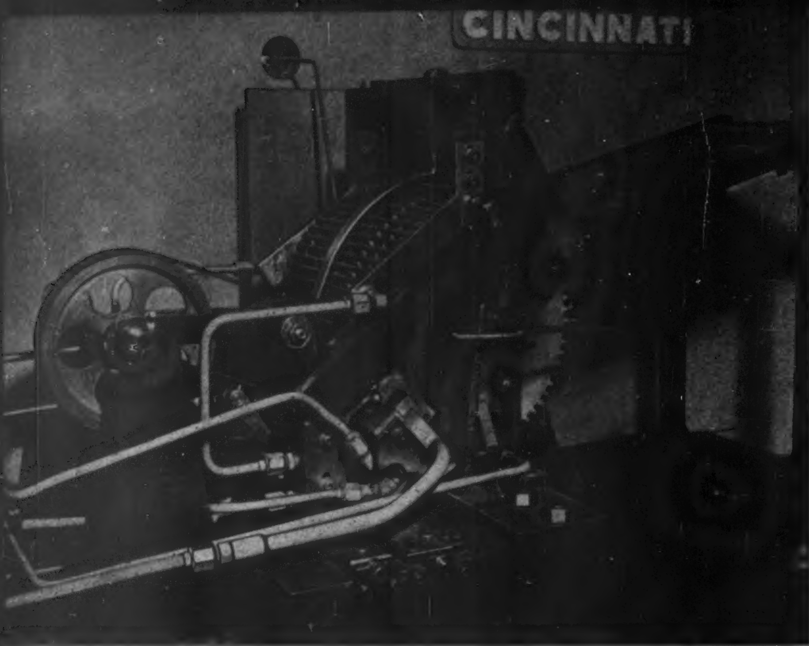


Fig. 3. The valve push-rods are automatically carried through heating zones on a Flamatic machine and then dropped into a quenching tank to harden the ball ends.

turn on their axes in the V-grooves of the drum as the cycle is performed. A flat surface is also ground on the end of each ball to insure that the over-all length of the push-rod will be held within 0.002 inch of the specific dimension. After the rods pass the grinding wheels, they are released from the cables and drop from the drum grooves.

The push-rods are next transferred to Cincinnati centerless grinding machines for the final operation. In these machines, the ground necks are used as guiding surfaces. The feeding side of one of the centerless machines is illustrated in Fig. 5. It will be seen that this equipment is also provided with an inclined magazine. The rods are automatically fed one at a time to hooks which lower them into grinding position against a stop. When the regulating wheel advances to each successive push-rod, it bears against the necks near the ball ends and starts the rod revolving as it is moved to the grinding wheel. There is a separate grinding wheel for each rod end.

The grinding wheels start to cut at the neck.

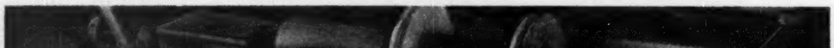
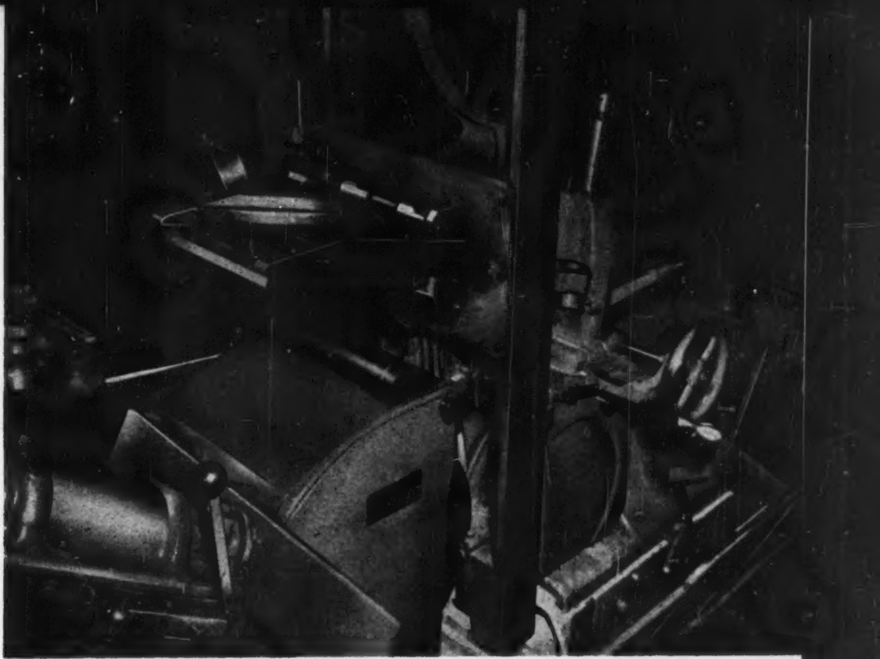


Fig. 4. Double-end grinding machine employed for rough-grinding the ball ends and a neck inside of each ball on the valve push-rods.

Fig. 5. One of a battery of centerless grinding machines employed for finish-grinding the ball and neck on each end of the valve push-rods.



Then the grooved portion of each wheel comes into action and grinds the ball surface to the required size and spherical contour. In addition, the flat on the ball end is ground.

To keep the grinding wheels trued to size and to the correct contour, dressing is performed after each cut. This is accomplished by means of a diamond, the location of which is controlled by the cam seen in Fig. 6. A follower moves along this cam during each dressing operation to govern the diamond movement. The cam is made in two pieces that meet at the diagonal slot seen near the center. This construction permits adjustments of the two cam halves so as to insure correct spacing of the surfaces that control the over-all length of the push-rods. The adjustments are made in the lengthwise direction.

Operation of the dresser is automatic, the operator keeping the magazine loaded with push-rods and checking an occasional work-piece to see that dimensional limits are being held. Each of the eight machines used for this final operation is capable of grinding approximately 300 push-rods an hour.

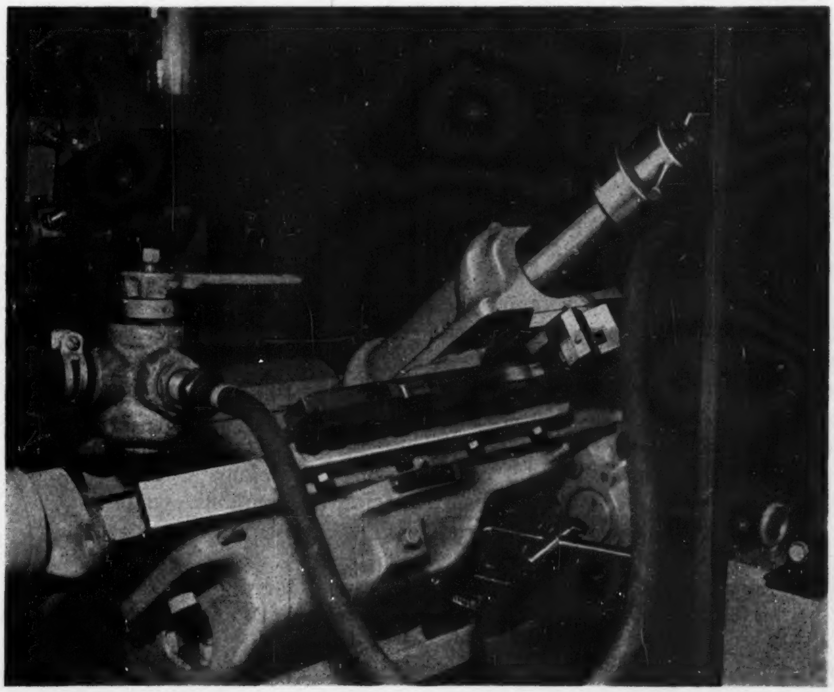


Fig. 6. Cam and follower on a centerless grinding machine which accurately control motions of diamond used for dressing the two formed wheels.

Materials OF INDUSTRY

The properties and new applications of materials used in the mechanical industries

Cast-Aluminum Plates and Bars for Dies, Jigs, and Fixtures

The availability of thick cast-aluminum plates and bars, machined to a high finish for tool and die use, has been announced by the Reynolds Metals Co., 2500 S. Third St., Louisville 1, Ky. Reynolds cast-aluminum plate and bar stock has a nominal tensile strength of 25,000 pounds per square inch, as cast, an average Brinell hardness of 70 (B scale), and an elongation of 0.5 per cent in 2 inches. It has a fine grain structure and a high surface finish (32-micro-inch); is flat (plus or minus 0.005 inch or less) and free machining; and can be welded. The casting technique used in its production eliminates any possibility of internal shrinks or voids and holds inclusions to an absolute minimum.

The plate can be used for the construction of hydraulic press form-blocks, hydraulic stretch-forming dies, jigs, fixtures, and other tooling. It will be available in a standard width of 48 inches and in three standard lengths of 96, 120, and 144 inches with thicknesses from 1/2 to 8 inches. The large-sized cast-aluminum bars find important application as fixture bases on spar mills. The bars will be available completely machined in widths and thicknesses up to 8 inches and in lengths up to 12 feet.

Anti-Spatter Compound Reduces Welding Clean-Up Time

An anti-spatter compound to increase the speed of welding operations by reducing the necessary clean-up time was recently introduced by Thompson & Co., 1085 Allegheny Ave., Oakmont, Pa.

The compound, which is designated Thompson Anti-Spatter, is brushed, sprayed, or wiped along the edges to be welded and over an area extending 6 to 8 inches from the weld. When the hot spatter from the welding operation strikes the compound, it will not adhere to the metal and thus can be easily wiped off without grinding or using power-driven wire brushes.

There are two types of the compound: No-Clean (SO-327), which provides a firm foundation for paint and need not be removed before priming; and Pickle-Off (SO-317), for use where the job is to be pickled and with chromium or stainless steel, where ease of removal is a desirable feature. The compound may be used in all kinds of weather. It causes no glare and has no disagreeable odor.

Black Finish for Stainless Steels and Cast and Malleable Irons

A process for blackening stainless steels and cast and malleable irons, called Black Magic S.S., has been developed by the Mitchell-Bradford Chemical Co., 2446 Main St., Stratford, Conn. It is a one-salt mixture, one-bath process operating at a temperature of 225 to 260 degrees F. Immersion in the blackening solution from five to fifteen minutes produces a lustrous, adherent black finish which will not chip, flake, or peel.

Silver-Bearing Solder Applied with Torch or Iron

All-State No. 430 silver-bearing stainless-steel solder, which is applicable with a soldering iron or torch at 430 degrees F., has been developed by the All-State Welding Alloys Co., Inc., White Plains, N.Y. It is said to cost less than silver brazing alloys and is easy to apply. The solder contains no lead, zinc, or cadmium, and can be chromium-plated.

Some of the physical properties of soldered stainless steel, copper, brass, and other metals are tensile strength, 10,000 to 28,000 pounds per square inch; shear strength, 10,000 to 15,000 pounds per square inch; and elongation in 2 inches, 10 to 28 per cent. Recommended applications include electrical connections, corrosion-resistant assemblies, and fabrications to operate at temperatures too high for lead-tin solders. It can also be used on copper tubing and refrigeration coils that come in contact with foodstuffs. No. 430 is available in 1/16-, 3/32-, and 1/8-inch wire on 1-pound spools and in 5-pound ingots.

Blackening Compound for Stainless Steel and Malleable Iron

Dulite 3-0 Black, a ferrous metal blackening compound, has been introduced by the Du-Lite Chemical Corporation, Middletown, Conn. Particularly effective for stainless steels, this compound will also produce a non-fading black finish on malleable iron. The maximum operating temperature required for processing is 240 degrees F. The compound is supplied in the form of a dry salt and may be mixed as needed.

Water-Soluble Powder Used for Rust Prevention

A mildly alkaline, water-soluble material used in a concentration of 1 ounce per gallon has been made available by Enthone, Inc., 442 Elm St., Dept. M, New Haven, Conn. Enthone Compound NR-31, as the product is called, can be used in still or spray wash tanks. During tests, treated parts have been protected against rusting in a 100 per cent humid atmosphere for periods of several weeks. Compound NR-31 is recommended for the prevention of rusting following cleaning, pickling, descaling, burnishing, and tumbling. It is readily removed by washing with water.

Dry Acidic Salt for Scale and Rust Removal

A dry acidic salt mixture which, when mixed in the proportion of 2 pounds of salts to 1 gallon of water, will remove scale and rust is being marketed by the Mitchell-Bradford Chemical Co., 2446 Main St., Stratford, Conn. "Quick Pik," as it is called, contains an inhibitor and also a foaming agent. This agent minimizes the attack of the acid on the base metal and produces a foam which covers the surface of the solution, eliminating acid spray and reducing fumes to a minimum. The solution can be used in a temperature range of from 70 to 150 degrees F.

A Synthetic Hard Rubber that Resists Chemicals and Heat

A heat- and chemical-resistant synthetic hard rubber compound called "Ace Temperon" has been brought out by the American Hard Rubber Co., 93 Worth St., New York City. This nitrile rubber (Buna-N) material exhibits great rigidity. It is available in the form of molded parts and sheet, rod, and tubes for machining a wide variety of shapes. Large fittings may be produced by forming sheets of the material around cores or mandrels while still soft, prior to vulcanizing. Standard pipe and fittings are made in the same manner.

Universal Cleaning Spray for Hand Spray Gun Application

Kelite Spray White is a new industrial cleaner being marketed by Kelite Products, Inc., 1250 N. Main St., Los Angeles 12, Calif. This cleaner, applied by a hand-sized pressure spray gun, safely removes grease, oil, wax, dirt, ink, light carbon, and other objectionable deposits from a variety of work-piece materials.

It cleans rapidly without heat, odor, fumes, solvents, fire hazard, or danger to the skin by spraying and wiping. Hard rubbing or scouring is seldom required. The spray gun is charged with air pressure from any source, and holds enough cleaning material for several hours of average cleaning.

Stainless-Steel Filter Material with High Tensile Strength

The availability of a porous stainless-steel filter sheet, designated Grade X, has been announced by the Micro Metallic Corporation, 35 Sea Cliff Ave., Glen Cove, N.Y. The sheet is ductile, has a tensile strength of 25,000 pounds per square inch, and has a smooth surface. Thickness tolerances of plus or minus 0.002 inch are maintained in the manufacture of these sheets. The sheet material is available in thicknesses of 0.020 to 0.125 inch with a mean pore opening of 10 microns.

Casting Impregnation Process Prevents Corrosion

A process for the impregnation of castings to make them impervious to the corrosive attacks of non-inflammable hydraulic fluids, as well as to insure the elimination of micro-porosity, has been announced by the Polyplastex International Corporation, Inc., 441 Madison Ave., New York City. This polyplastic "MC" process has been used to impregnate parts in systems that employ the hydraulic fluids, and more recently to impregnate mortar shell castings. Manufacturers and special service industries such as heat-treating plants, platers, and anodizers, can be licensed to use this process.

Magnesium-Alloy Ingot for Use in Die-Casting

To lower melt loss and increase efficiency when using magnesium for die-casting, the Dow Chemical Co., Midland, Mich., has developed a magnesium alloy containing beryllium. It is designated Dowmetal AZ91B, and has now been made available in ingot form for the commercial magnesium die-casting industry.

Forming and Assembling

By RALPH WAGNER
Chief Tool and Process Engineer
Crosley Division
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CONDENSERS for Crosley refrigerators and food freezers consist of fifty thin steel fins into which a bent steel tube is pressed. The condenser fins are stamped from 0.012-inch thick cold-rolled steel, and the coils are bent from 1/4-inch diameter Bundy steel tubing, having a wall thickness of 0.028 inch. Methods employed at the Nashville plant of Crosley for rapidly forming and assembling these parts will be described in this article.

The fins, one of which is shown in Fig. 1, are pierced, extruded, and cut off from 4-inch wide steel coil stock in a three-station progressive die mounted on the Minster 22-ton press shown at the left in Fig. 2. The stock is automatically fed into the first station where the eighteen partial holes and nine connecting slots in each fin are pierced. Scrap slugs from the pierced holes and slots fall through the die, down a chute, and into the tote pan seen at the lower left.

At the second station of the progressive die, the edges of the partial holes are extruded to a depth of 1/16 inch, thus developing a diameter which will produce a light press fit on the condenser coil. Fins are cut off to the required 6 1/4-inch length at the third and final station of the progressive die.

Attached to the die-shoe at the exit end of the progressive die is a unique mechanism for automatically stacking the cut-off fins in a box with the correct spacing between fins required for assembly on the coil. The mechanism is connected to the press ram by levers and a rack and pinion, so that the vertically positioned, fin-holding box is automatically lowered the required amount after each press stroke to receive the fin as it is cut off from the strip stock.

Each box accommodates fifty fins. The filled box falls on a conveyor belt (seen at the center in Fig. 2) which carries it to the coil assembly station. While one box is being filled, empty ones are placed in position above, so that continuous operation of the press is possible.

Condenser Coils and Fins

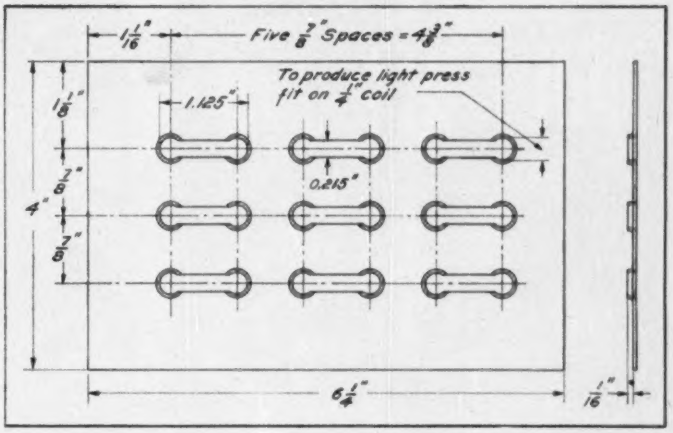


Fig. 1. Condenser fin stamped from 0.012-inch thick cold-rolled steel. Fifty of these fins are pressed onto a tubular coil.

Tubes for the condenser coils are cut to the required length and bent around a 7/8-inch diameter mandrel with a shoe type bending fixture that is actuated by hand. A total of seventeen 180-degree bends, having a radius of 7/16 inch, are made by gaging one end of the tube against fixed stops. Bent portions of the completed coil are flattened to fit the pierced slots in the fins. Also, the two ends of each condenser coil are bent and flared to accommodate the required connections.

In assembling the condenser coils, a box containing fifty equally spaced fins is clamped to a bench fixture, Fig. 3, and a plate—on which are suspended reinforcing fingers that fit between and back up the fins—is pneumatically lowered into position. Then a bent coil is fitted into the grooves of a special head mounted on the piston-rod of a large air cylinder. When the cylinder is actuated, as shown in Fig. 4, the coil is pushed into the pierced holes in the fins.

After the piston-rod of the air cylinder has

Fig. 2. A three-station progressive die is employed on the 22-ton press seen at the left to pierce, extrude, and cut off the fins for condensers.

Fig. 3. A box containing fifty accurately spaced fins is clamped in a bench fixture, and reinforcing fingers are lowered into position between the fins.

been retracted, the assembled condenser is removed from the fixture and dropped out of the stacking box. The light press fit of the fins on the tube keeps the fins properly aligned without the need for spacers or other fastening means. The empty box is returned to the fin stamping press. Mounting brackets are attached to the assembly by silver soldering, and the completed condenser, such as the one seen in the heading illustration, is hung on a conveyor for cleaning and painting with black japan enamel.

Industrial Use of Radioisotopes

In the six and a half years the Atomic Energy Commission has been distributing radioisotopes, it has made over 32,000 shipments to some 1200 institutions, about 40 per cent of them industrial firms. The Carborundum Company, using radioactive gages to measure the thickness of coated abrasives and final product, expects to save enough money on rejects and shut-downs in a few months to pay for the gages.

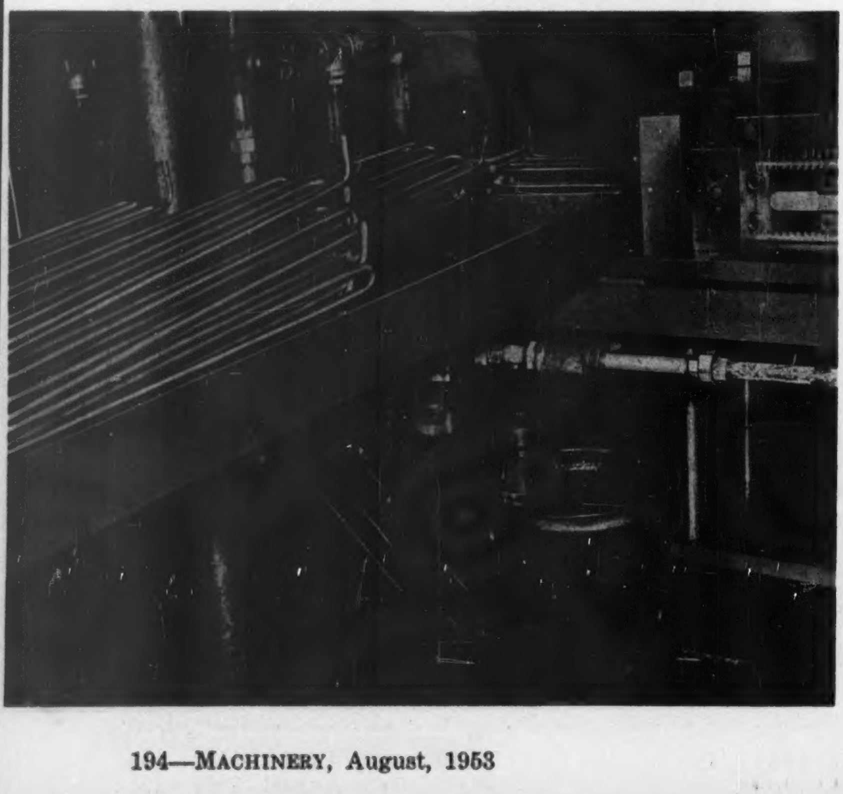


Fig. 4. Condenser coil, formed by bending 1/4-inch diameter tube, is pressed into fins (right) by the piston-rod of an air cylinder.

Volatile Corrosion Inhibitor Insures Rust-Free Die Sets

By DAVID MYERS,
Production Manager
Producto Machine Co.
Bridgeport, Conn.

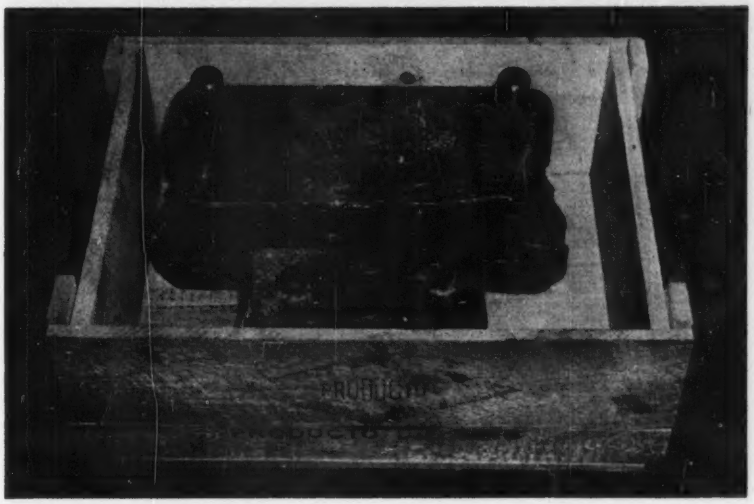


Fig. 1. Condition in which die sets used to arrive in customers' plants when they were coated with grease to prevent rusting during shipment

IN the business of manufacturing some 800 sizes of die sets, the Producto Machine Co. has had the periodic problem of die sets rusting during shipment. Normally, the method employed to protect the precision machined surfaces of these die sets, regardless of size, has been to coat them with a light oil and a grease. The grease had to be melted and compounded with a solvent in order to employ the brush method of coating the sets. In spite of this, rusting occurred, particularly on shipments that required from three to four weeks.

Also, customers objected to the task of removing the grease, even if no rust was present. Fig. 1 illustrates the condition in which many die sets used to arrive in customers' shops. It was necessary to remove the grease, as well as sawdust and wood scraps which had fallen on the die set. The use of grease as a protective coating made the likelihood of accident a distinct problem, and the handling of slippery die sets was a constant hazard to employes.

The problem of shipping precision machined products is particularly acute in winter, because the "shooks," or broken down box frames, are received in a damp condition. As a result, the die sets were being shipped in a continually moist atmosphere, and corrosion persisted de-

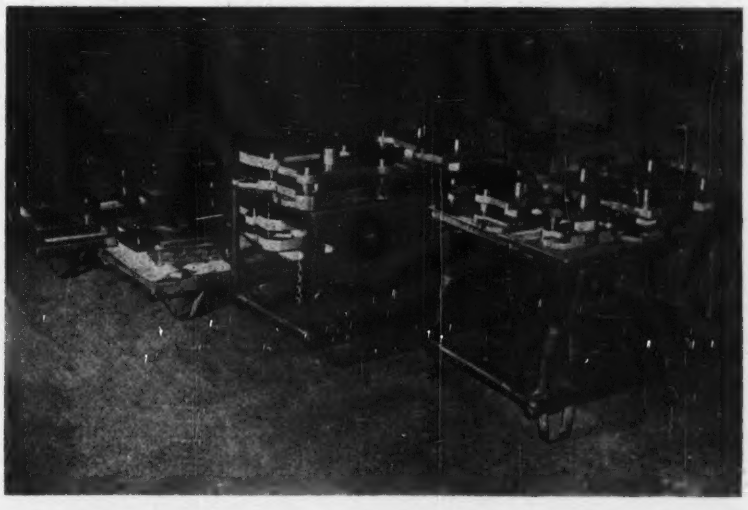


Fig. 2. Precision machined die sets and die-blocks arrive in shipping room coated with a light oil and ready for packing in wood boxes

Fig. 3. Perforated shakers, filled with powdered volatile corrosion inhibitor, are used to coat the bottom of all boxes before die sets to be shipped are enclosed

spite the oil and grease protection. Actually, the physical act of packing, where the shipping personnel handled the die set before the grease was applied, was the basic problem. Hand perspiration set up a chemical reaction that developed corrosion before the protective medium was brought into action.

About two years ago, as the result of exhaustive research, a new product just then appearing on the industrial market was tried. This was a volatile corrosion inhibitor being marketed by the Shell Oil Co., called VPI, which was intended to prevent corrosion in the presence of moisture and moisture-bearing air.

A test shipment was made using this crystalline salt, about thirty sets being packed with VPI sprinkled in the bottom of the boxes. On arrival in San Francisco, about four weeks later, the sets were found to be absolutely rust-free. They could be put in use immediately, without the necessity of removing messy grease compound. Since that time, thousands of die sets and accessories have been received with no evidence of rust.

The procedure is quite simple and surprisingly effective. Precision machined die sets and die-blocks arrive in the shipping room coated with a light oil and ready for packaging, as seen in Fig. 2. Before the die sets are put into the wooden boxes, the bottom of the boxes are sprinkled with VPI, using a perforated can as shown in Fig. 3. The die sets are then secured in the box, Fig. 4, and the cover nailed on. The powder begins to vaporize, and the box cover acts as a barrier against the escape of the vapor.

The economy of this new method is rather obvious. There are savings on the volume of protective grease formerly used and in the man-hours required for application. Most important of all, however, this procedure permits improved service, and the customer can immediately set up his dies on the punch-holder and base without the necessity of removing grease.

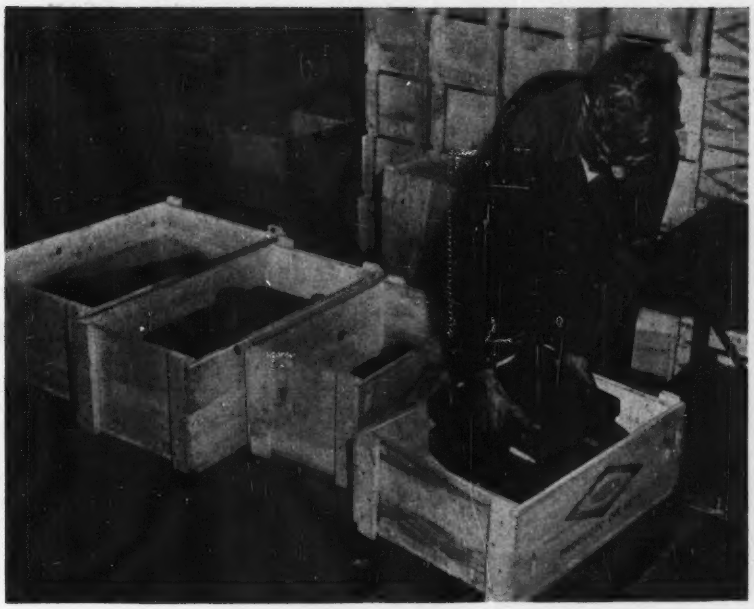
This product, VPI, comes under the classification of a nitrate salt (dicyclohexylammonium nitrate). Actually, the vapor from the crystals condenses on metal surfaces or dissolves in condensing moisture. Steel surfaces cannot be protected by VPI in open areas as there must be a barrier to prevent escape of the protective vapor. Hermetic sealing, however, has not been found necessary.

Although the shaking of crystals into the bottom of the box has been found to be a most effective method of assuring adequate rust prevention at Producto, other companies use different methods. Some concerns dissolve the crystals in alcohol and water and spray the solution on the surfaces. Others use the solution as a dip for parts in the process of machining operations.

The corrosion inhibitor can also be coated on kraft paper and used as a wrap, a method which was found to be too expensive for shipping some 800 different sizes of die sets. Machine manufacturers are also protecting equipment by enclosing a few grams of VPI in muslin bags and hanging them from various parts of the machine, never farther than two feet from the surface to be protected.

The duration of protection depends on the amount of inhibitor used and how fast it is lost by package leaks and decomposition. Applied

Fig. 4. Die sets are immediately placed in boxes on top of volatile corrosion inhibitor powder, which begins to vaporize. The box cover serves as an effective vapor barrier



liberally, for added guarantee of protection, the amount required is still small. As a matter of fact, 12 pounds takes care of a month's shipment of die sets. It is the cheapest source of rust prevention found to date at Producto, and the conclusive results obtained indicate that the procedure will undoubtedly be used for some time to come.

Physically, VPI is a white, crystalline solid that melts at 310 degrees F. without decomposing. The pH of its water solution is 7 and it is practically odorless. One gram saturates about 20,000 cubic feet at room temperature. The compound is moderately soluble in water, very soluble in methyl alcohol, slightly soluble in low molecular weight polar solvents, and practically insolvent in hydro-carbons, as has been determined from past experience.

Jigs and Fixtures Quickly Assembled with "Erector Set"

Substantial savings are being achieved by the General Electric Co.'s J-47 jet-engine plant at Evendale, Ohio, through the use of an industrial "Erector set" for making jigs and fixtures. The set is composed of interlocking blocks, clamps, bolts, bushings, and other parts, as seen in the illustration, which can be assembled in an almost infinite number of combinations.

The set, based on the Wharton universal jig and fixture system, consists of about 450 pieces used to assemble jigs and fixtures for machining and assembling small quantities of parts. Toolmakers can quickly assemble dependable temporary tooling to almost any design. The job completed, the tooling can be disassembled for re-use.

Many different fixtures such as the one shown can be quickly made with the industrial "Erector set" containing a total of 450 blocks, clamps, bolts, bushings, and other parts.

In Shops Around

Camera highlights of some interesting operations performed in various metal-working plants throughout the nation

Cleaning jet-engine fuel control parts at the Holley Carburetor Co., Detroit, Mich., with a General Electric ultrasonic generator. Operator places part to be cleaned in solvent bath, where it will be subjected to intense high-frequency sound waves produced by quartz crystal transducer.

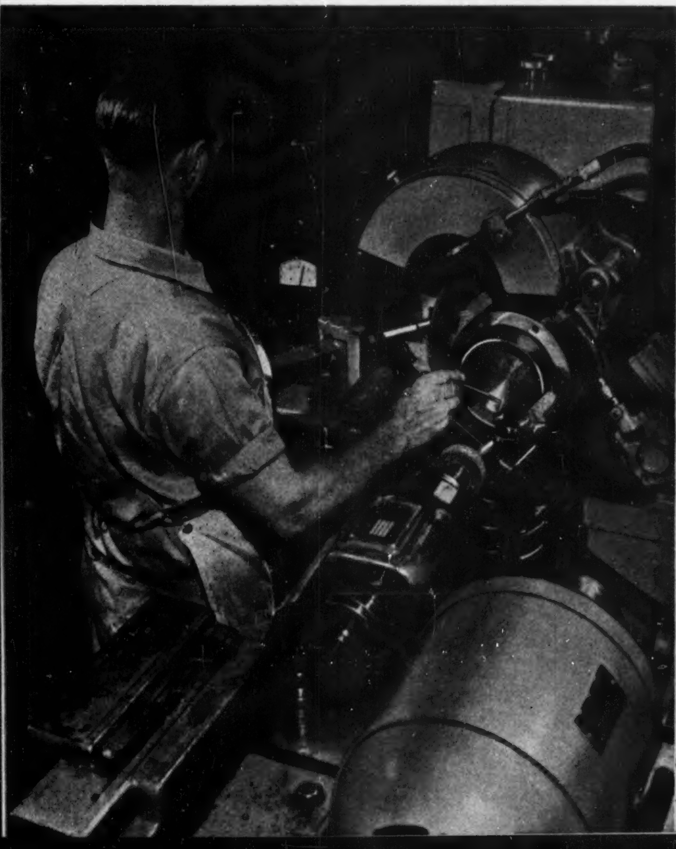
Roll-welding fuel manifolds to jet-engine exhaust cones at Solar Aircraft Co., San Diego, Calif. Special Taylor Winfield seam welder has upper electrode that rolls around circular path while work remains stationary. Lower electrode is essentially a work clamp. The machine features adjustable circle size and rolling speed, and can be readily converted to conventional circumferential or longitudinal welding.

the Country

A company-designed multiple flush-pin gage in use on disc-shaped part at Wood-Ridge, N. J., plant of Wright Aeronautical Division, Curtiss-Wright Corporation. Indicator, removable for use with other similar gages, provides inspection accuracy. Top of gage beam is held to mean dimension of part, and serves as reference surface. Carbide-tipped checking points are not stepped, as in conventional flush-pin gages.

Centering a "Double Zero" roller bearing on a magnetic chuck at the Timken Roller Bearing Co., Canton, Ohio. Outer race, already finished, is being indicated to within 0.00002-inch run-out before finishing inner race on internal grinding machine. With chuck at partial holding power, part is tapped to "run" by eye, then precisely centered by means of the Cleveland Indi-Ac electronic indicator.

Obtaining varying angle along aluminum die form-block on a special Orton tilt shaper at the Ryan Aeronautical Co., San Diego, Calif. Cutter-head unit and motor are mounted on an adjustable quadrant. As one operator feeds work into cutter, another operator continuously adjusts angle of cutter by means of handwheel, bringing pointer on protractor scale to conform with readings on template.



A Precise Angular Standard Made from Gage-Blocks

An exceptionally accurate polygon having twenty-four sides has been constructed by the National Bureau of Standards to serve as a basic standard of angular measurement. Made of precisely machined and polished gage-blocks accurately positioned on a circular baseplate with 15-degree angles between adjacent faces, the polygon permits the comparison of an "unknown" angle with consecutive angular intervals until the total of such intervals equals an integral number of perfect or 360-degree angles.

The polygon, seen in Fig. 1, was designed primarily for use in the calibration of the 15-, 30-, and 45-degree angle-blocks of the master sets which industry uses to control the shape of mechanical parts. The principle of the device, however, is expected to find considerable application in routine angular measurements for optical and mechanical work.

Calibration of an angle-block by means of the polygon consists essentially in comparing the angle-block with one or more angular intervals of the polygon. Angles are measured by sighting an autocollimator on the two faces which define an angle, as seen in Fig. 2, and then determining the angular difference between the two settings. Each polished face acts as a plane mirror and a sharp image of the autocollimator cross hairs is formed.

In practice, any error present in the calibration of the polygon is eliminated by comparing the angle-block with a sufficient number of consecutive intervals to include an integral number of polygon rotations or circuits, that is to say, an integral number of perfect 360-degree angles. In this way it has been possible to determine the angles of master blocks with errors of approximately 0.1 second.

The mechanical requirements for a standard polygon of the requisite accuracy for this type of work are quite rigorous. For example, the defining surfaces must be flat to one or two millionths of an inch over practically their entire area, the surface roughness of the faces must average less than 0.5 micro-inch r.m.s., and the variations in the angle between the defining faces and the axis of the polygon must not be greater than 15 seconds.

To fulfill such requirements, it was decided to assemble the polygon by fastening gage-blocks—which were already available with satisfactory defining faces—to a circular baseplate in such a way that their outer faces would form the standard polygon. To keep the diameter of the plate within reasonable limits, the gage-blocks were placed in two layers of twelve each.

The circular base of the polygon is 0.75 inch thick and 8 inches in diameter. It was made of oil-hardened steel and heat-treated for maximum dimensional stability. After hardening, the base was ground on both sides and then hand-lapped until the error in parallelism of the two surfaces was less than 0.0001 inch, and the maximum error in flatness of each surface was less than 0.00006 inch. A rather high finish was imparted

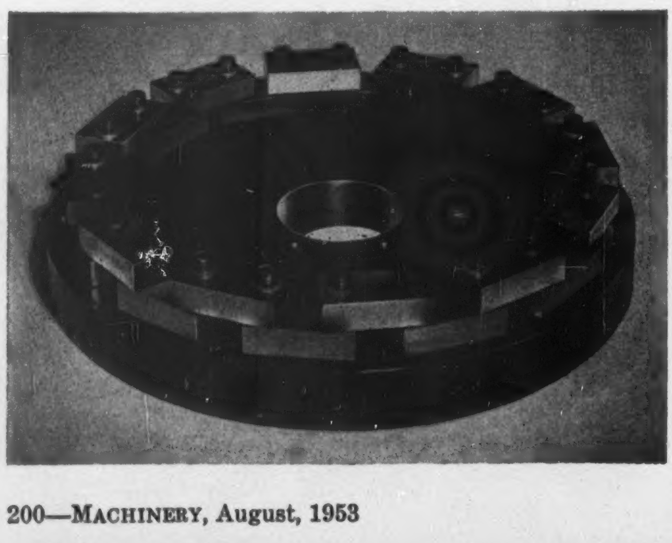


Fig. 1. Twenty-four-sided polygon constructed by the National Bureau of Standards to provide a precise basic standard of angular measurement

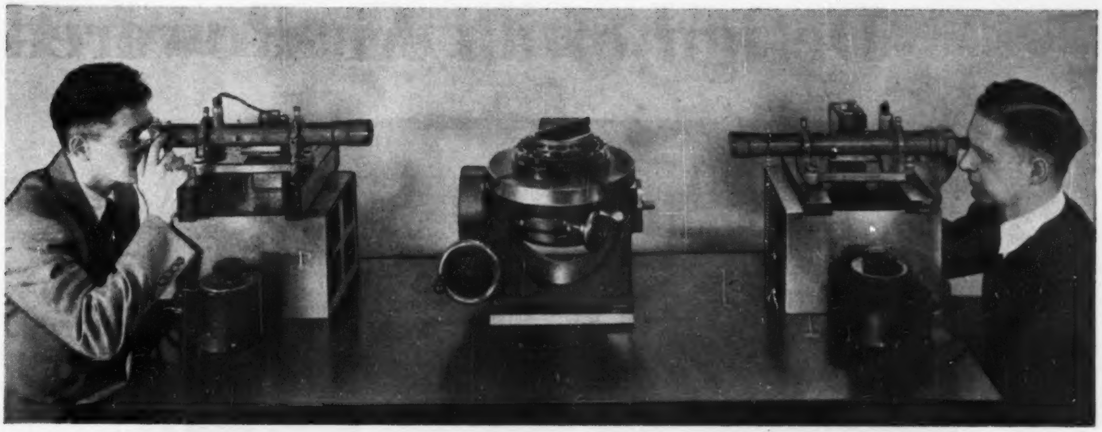


Fig. 2. Calibration of a 45-degree angle-block by means of the standard polygon seen in Fig. 1

to one surface in the final lapping so as to permit easy wringing of the special gage-blocks in the required position.

Modified 0.750-inch, rectangular gage-blocks were used for the defining faces. All four lapped sides were flat within 0.000005 inch and adjacent sides were square within 2 seconds of arc. The surface roughness of each of the sides was less than 1 micro-inch r.m.s. This was reduced still further by polishing with a cloth lap. The thickness (nominally 0.375 inch) of the twenty-four blocks in the group varied less than 0.00003 inch. The bottom layer of blocks was so selected that adjacent blocks did not differ in thickness by more than 0.00001 inch. This permitted at least partial wringing of the blocks in the upper layer to those in the lower layer, and reduced distortion arising from the pressure of the clamping screws.

Twenty-four tapped holes in the baseplate permitted the use of the same screws for fastening both the upper and lower layers of gage-blocks. The holes were countersunk and then counterbored to a depth of 1/4 inch to minimize distortion of the base caused by tension of the clamping screws.

The positioning of the gage-blocks on the baseplate was carried out on a carefully adjusted rotary table with the aid of 15-, 30-, and 45-degree angle-blocks, a solid square, and an autocollimator. The 0-, 90-, 180-, and 270-degree faces were positioned by means of the square, and the intermediate faces by adding or subtracting 15-, 30-, and 45-degrees from these positions.

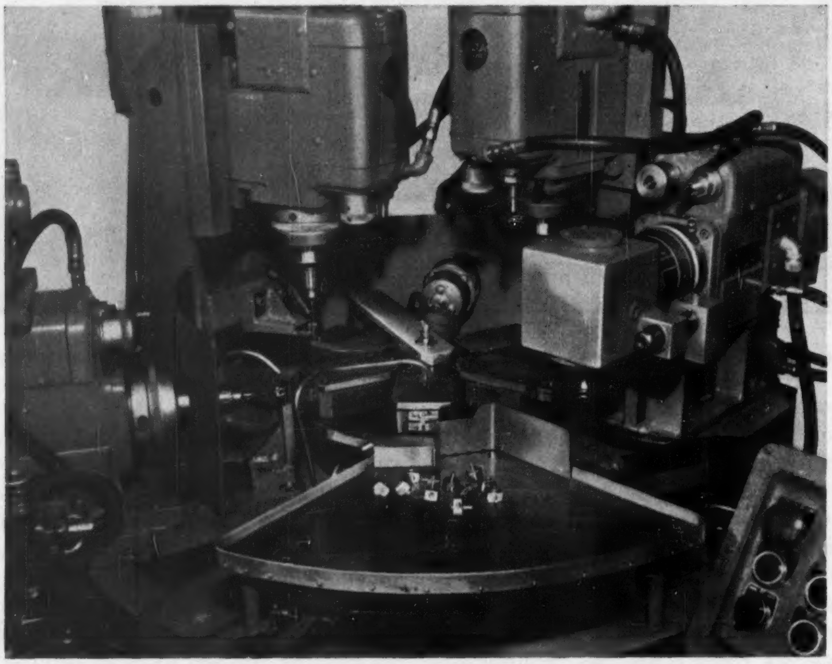
Two autocollimators and a rotary table were used in calibrating the polygon. The polygon was mounted on the rotary table, and each autocollimator was placed on a substantial iron base with its optical axis in line with the junction of the upper and lower layers of blocks. To prevent dimensional changes in the surface plate owing to the body heat of the observers, the entire apparatus, except for parts of the autocollimators, was enclosed in an insulated box. Each autocollimator was centered on the appropriate polygon face by viewing the image of the cross hairs with a low-power microscope.

After recording the readings of the two autocollimators for one angular interval, the rotary table on which the polygon was mounted was then turned to present the faces of the adjacent angular interval. This process was repeated until every interval of the same nominal size had been measured and the circuit closed. In order to provide corrections of equal precision for all intervals, 552 measurements involving 76 closures were made to obtain all possible sums of consecutive angles. From these measurements corrections were derived statistically for each interval.

Although the polygon was designed primarily as a master for angle-blocks, similar assembled polygons should prove useful in a variety of fields. For example, simple polygons of a few blocks could easily be assembled for use as masters or gages in optical or machine work.

The polygon is also well suited to the calibration of circular dividing equipment such as rotating tables. Alone it permits the calibration of 15-degree intervals; used in conjunction with other similar polygons it will measure intervals as small as 1 degree. The ease and precision with which defining faces can be positioned on an assembled polygon suggest the possibility of constructing a single polygon having, in addition to the usual larger intervals, one or more blocks set at such angles as to subdivide the principal intervals. The construction of such a polygon is now under way at the National Bureau of Standards in Washington, D.C.

Design of an Air-Powered



AN air-powered hydraulic system is one in which compressed air provides the energy and oil provides the control element. A correctly designed and applied air-powered hydraulic system combines the simplicity, convenience, and energy-storing features of compressed air with the smoothness and flexibility of a conventional hydraulic system. Such a system, however, supplements but does not replace conventional hydraulic circuits.

The principle of air-powered hydraulics is not new, but it is only in recent years that its application has become widespread. Most applications have been made by means of commercially available standard units which the customer attaches to his own machine. The drilling units made by the Delta Power Tool Division of the Rockwell Mfg. Co. are, however, built around a sealed air-powered hydraulic system and are designed to be an integral part of a production machine.

There are basically two air-powered hydraulic systems in use. The more common system utilizes one cylinder for the compressed air to furnish the power, and a second one for oil, to provide a dashpot-like control element. The two cylinders are connected mechanically, sometimes with an adjustable backlash to furnish rapid approach.

The second system may use two or more cylinders, but in each cylinder one side of the piston contains air for the driving force, and the other side oil for control. The main cylinder is the power cylinder of the system and the others act only as receivers or reservoirs. In some cases, the secondary cylinders may be replaced by a reservoir with oil coming up from the bottom and air on top. The position of the cylinders relative to each other is immaterial, since they are connected hydraulically rather than mechanically. This makes it possible to insert control means in the connecting piping and achieve a control that functions in a manner very similar to a conventional hydraulic system. Also, in this system the receiving cylinders can be made large so as to take care of normal leakage and volume changes.

Delta drill units, such as the one shown in Fig. 1, are typical of this second system. Since no cams are employed, these air-powered hydraulic drill units can be quickly and easily set up. Three infinitely variable adjustments provide positive, accurate control of the length of rapid approach, the feed, and the depth. Power feed is hydraulically controlled, independent of motor and spindle speed. Compressed air provides the force (on a sealed, pumpless hydraulic system) to move the spindle forward, thus completely eliminating lost motion and backlash.

From the flow diagrams of this unit, Fig. 2, it can be seen that the air-hydraulic system involves only three major moving elements.

Hydraulic Drilling Unit

By CLARENCE JOHNSON, Development Engineer
and
PAUL BUTZIN, Director of Engineering
Delta Power Tool Division, Rockwell Mfg. Co.,
Pittsburgh, Pa.

These elements are the main power piston *A*, (which is integral and concentric with the quill or spindle-carrier *B*), the floating feed control piston *C*, and the floating rapid approach control piston *D*. A body of oil is sealed between these movable pistons, and, as compressed air from the shop supply line is alternately applied to the ends of the hydraulic circuit, the oil will flow back and forth through the valve system, thereby controlling the movement of the pistons. The pressure of this oil is also imposed on a limit switch *P* in the cycle control unit *F* by means of an actuating bellows *O*.

The start of the cycle is shown at the top of Fig. 2. Compressed air has been applied to the left-hand side of the main piston *A* by the four-way, solenoid-operated valve *H*, thus forcing oil from the main cylinder to the upper control elements and exhausting air from the rapid approach piston *D* and feed piston *C*. The main piston will move forward (toward the right) rapidly, at a rate governed by the resistance of the oil channels.

Oil flowing from the chamber around quill *B* cannot enter the feed cylinder due to the ball-check valve *K*, and therefore enters the rapid approach control cylinder and moves the rapid traverse piston *D* against its adjustable stop-screw *J*, as shown in the center of Fig. 2. The rate of rapid traverse of the quill can be controlled through a wide range by adjustments of the rapid approach metering valve *L*, which is located in the oil passage between the main cylinder and the rapid approach control cylinder. The distance of rapid approach is easily varied by changing the position of stop-screw *J*.

After the rapid approach control piston has reached its stop — and if the feed rate adjustment valve *M* is completely closed — the main piston or quill will go no further. However, if the feed adjustment valve is open to obtain the desired feed rate, the quill will feed forward by allowing hydraulic fluid to meter through the adjustable orifice into the feed control cylinder. As the quill feeds forward, thus displacing oil from the main cylinder, the feed piston will float back freely to accommodate this oil in the feed cylinder. The back pressure of the trapped oil in front of the main piston prevents the quill from lunging forward should the load suddenly disappear (which happens when a drill breaks through the work).

The quill and spindle will advance at a predetermined and controlled rate until the positive,

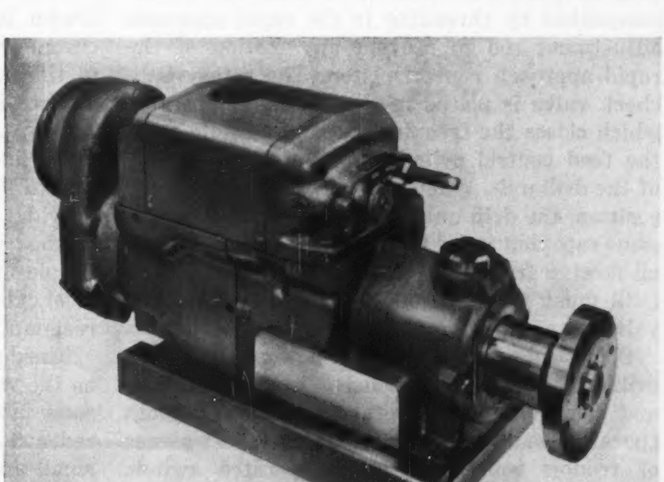


Fig. 1. Air-powered hydraulic drilling unit having infinitely adjustable feed rates from 0 to 180 inches per minute

but adjustable, final depth stop-nut N is reached, as shown at the bottom in Fig. 2. When the quill movement is arrested by the depth stop-nut, there will, of course, be an instantaneous fluid pressure drop within the hydraulic system. This drop in fluid pressure will allow the bellows O in the cycle control unit F to retract.

The motion of the bellows due to the drop in oil pressure actuates limit switch P, which electrically reverses the four-way solenoid air valve H. As the valve is reversed, air pressure will be exhausted from behind the main piston, and applied to both the feed and rapid approach control pistons. The control pistons will thus force hydraulic fluid back into the main quill cylinder, returning the spindle rapidly to the full retracted position. Here the quill resets the cycle control unit through pin G and switch E, and the cycle may be repeated. The retraction metering valve Q is fully adjustable, and provides a means for regulating the rate of rapid return of the quill.

As shown at the top when the quill is returned to its fully retracted position, the rapid approach cylinder is completely scavenged of all hydraulic fluid. This is not true of the feed cylinder, which contains a reserve supply of hydraulic fluid. The reserve supply of fluid permits continuous duty of the air hydraulic system for well over 150,000 full-stroke drilling cycles before additional hydraulic fluid need be added to the system.

There is also a means within this hydraulic system to obtain back feed of the spindle through the same adjustment that provides for forward feed. This unique system allows the drill unit to be utilized for such operations as back spotfacing and tapping. To take advantage of the back-feed provisions, all rapid traverse of the drill unit must be eliminated. This can be accomplished by threading in the rapid approach adjustment rod to prevent any motion of the rapid approach control piston. The rotary ball-check valve is placed in the back-feed position, which closes the free flow passage of fluid from the feed control cylinder to the main cylinder of the drill unit. When this valve is in the closed position, the drill unit quill will feed back at the same rate that it fed forward, since the hydraulic oil flowing from the feed cylinder to return the quill must meter through the same adjustable valve as on the forward stroke.

Original designs of these air-powered hydraulic drilling units were expensive to manufacture, and some difficulties were experienced in both operation and maintenance. The greatest source of trouble was the pressure-operated switch. Originally, a double-action limit switch was used, the switch being operated by a cam in one direction and by a hydraulic piston responsive to pressure changes in the other direction. This arrangement was extremely sensitive with regard to the location of the switch, and was further complicated by the fact that it was necessary to prevent leakage of hydraulic fluid in the actuating cylinder of the switch. However, friction had to be kept at a minimum so as to retain sensitivity of response to pressure changes. Another difficulty was the necessity of opening up the hydraulic line every time the switch assembly required service. This resulted in leakage of hydraulic fluid and the entrance of air into the hydraulic system.

To overcome the difficulty, the hydraulic actuating cylinder of the switch mechanism was replaced with a bellows. Also, in order to minimize failures, the plunger attached to the bellows was arranged with fixed stops so as to limit deflection within the bellows and avoid overtravel. An adjustable spring device to control the operation of the bellows and a mechanism to cause the bellows to trip the switch at a predetermined pressure drop were also provided. The double function of the original limit switch was divided by employing two separate limit switches. The entire assembly was mounted in a plastic enclosure so that the unit could be replaced in a short time when service was required, without opening the hydraulic circuit.

The hydraulic cylinders of the drill unit must have hard, smooth surfaces that will resist corrosion when subjected to moisture entrapped in the air system. Originally, the control cylinders were made of stainless steel and the main body cylinder of Meehanite cast iron. The stainless-steel cylinders were difficult to machine, and the Meehanite cylinders had to be chromium-plated and reground. To overcome these difficulties, all cylinders were made from seamless drawn tubing which was coated with a flash-chromium-plating. Although finishes obtained in this way were satisfactory, the surfaces did not resist corrosion sufficiently.

It was then decided to put a brass liner inside the cylinders to overcome the corrosion problem and to flash chromium-plate the brass liners to provide a hard, wear-resistant surface. This method proved to be economical and relatively simple in production, and provided strong steel cylinders with smooth, hard, and corrosion-resistant surfaces.

The development of the quills, which also serve as the main piston of the drill head, resulted in some interesting problems. Oil leakage had to be reduced to a minimum, since the reserve was small and air had to be kept from leaking into the oil. Some sealing problems were encountered because the quills are often covered by a mixture of chips, dust, oil, and grease. Many seals were

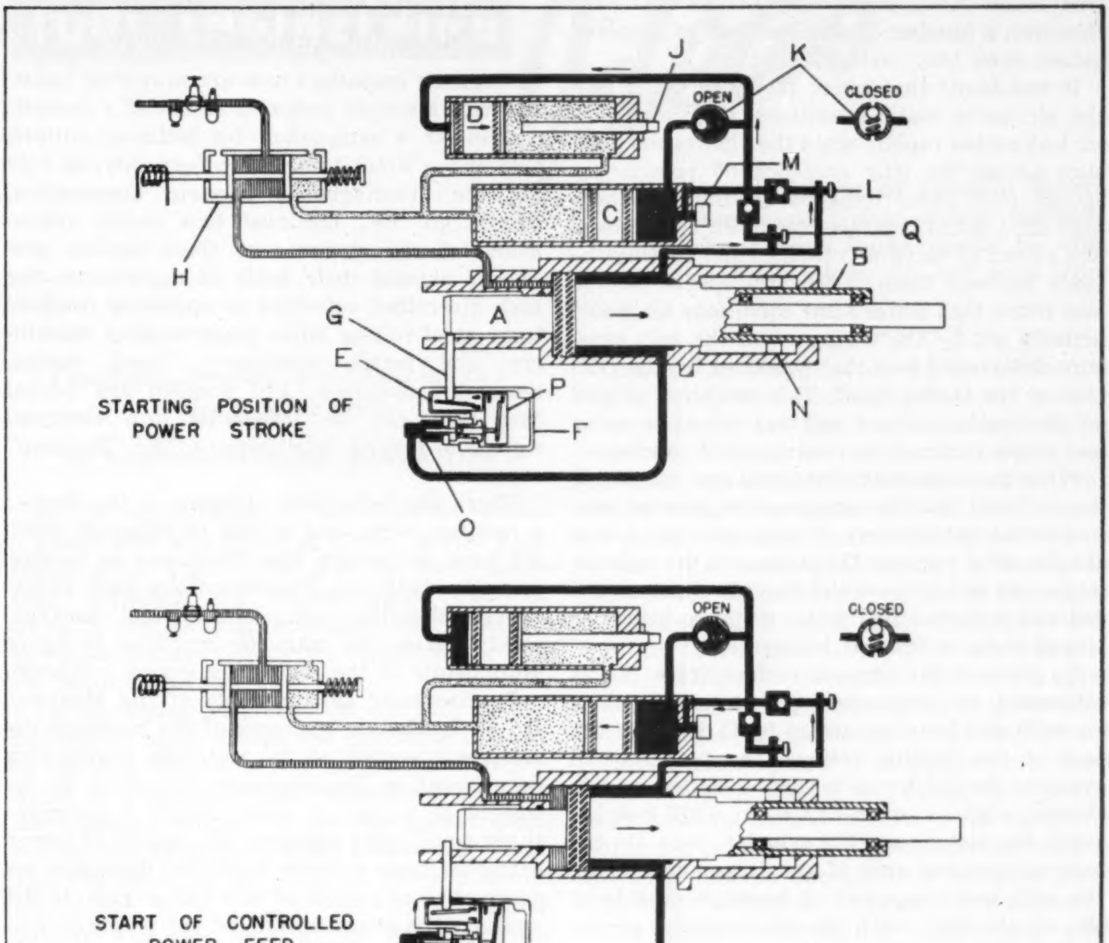


Fig. 2. Flow diagram of air-powered hydraulic drilling unit seen in Fig. 1. Start of power stroke is shown at the top, controlled power feed stroke at the center, and return stroke at the bottom.

tried before it was found that O-rings were best. However, a number of problems had to be solved before even they were satisfactory.

It was found that where the rings would hold the air under static conditions, they would let air leak rather rapidly when the differential pressure across the ring exceeded 50 pounds per square inch under dynamic conditions. Where high differential pressures occurred, the problem was solved by using two O-rings and venting the space between them to the atmosphere. It was also found that under some conditions air would actually get by the O-ring when the only pressure differential was that produced by the friction of the O-ring itself. This condition existed on the floating pistons and was solved by using two rings, contrary to recommended practice.

With the relatively low pressures employed, it was found that the squeeze recommended was, in general, satisfactory. It was also found that the clearance between the piston and the cylinder wall could be increased and that the finish on the rod and cylinders had to be 10 micro-inches or less in order to prevent leakage.

To preserve this smooth surface finish, it was attempted to eliminate metal-to-metal contact on walls and bearings sealed by O-rings. In the case of the floating pistons, the best way to preserve the finish was to carry each one on two O-rings, with a clearance of about 0.015 inch between the pistons and the cylinder walls. On the main piston and quill of the larger drill units, the quill was supported on bearings outside of the oil chamber, with enough clearance at the seal so that metal-to-metal contact was avoided where these sliding members passed through. However, in the case of the smaller units, the bearing had to be placed in the seal of the quill.

A number of materials were tried at this bearing point. The final solution was a babbitt lining of this bearing adjacent to the O-ring. With this design, the hard foreign particles become imbedded in the soft babbitt without damaging the hardened sleeve on the quill. A test unit has been operated in excess of 15,000,000 cycles without replacement of any parts or O-rings. This test unit has shown no increase in leakage, and the quill has acquired a mirrorlike finish.

The feed valves employed on the drill units are an entirely new design, and have been proved satisfactory. The movable portion of the valve fits closely into a lapped hole of the valve body; upon rotation of the valve, axial movement is obtained by the use of a standard thread. The end of the valve stem slides over a triangular hole that is the orifice for controlling the flow of hydraulic fluid. A triangular hole was used to obtain relatively uniform change in the rate of flow for each increment of valve stem movement.

Magnetic Amplifiers Provide New Means of Automatic Control

Magnetic amplifiers now are providing industry with a simple foolproof means of automatic control. In a symposium for technical editors, held at the Hotel Astor, New York City, on July 21, the Westinghouse Electric Corporation, Pittsburgh, Pa., disclosed how recent refinements of the elements of these devices now greatly expand their fields of application—for such diversified activities as operating machine tools, steel rolling mills, paper-making machinery, and textile machinery. Speed, torque, tension, horsepower, and position are typical cues that can be translated into electrical signals to furnish intelligence to the "Magamp" regulator.

There are three basic elements in the device: a rectifier, wire, and a ring of magnetic steel. All have an infinite life. There are no moving parts to wear out. Characteristics such as extreme reliability, compactness, and packageability enable the magnetic amplifier to figure prominently in the regulating system spectrum.

In discussing the principle of the Magamp, Dr. R. A. Ramey, manager of the magnetic development section of the materials engineering department at Westinghouse likened it to the control of a dam of water, where a comparatively small valve regulates the amount of power extracted from a water level that fluctuates because of equal periods of rain and no rain. In the analogy, the characteristic of the magnetic material is the dam. Electrical voltage is comparable to the periods of rain and no rain, in that it has both positive and negative half-cycles.

During the negative half-cycles, a small current flows into the control winding, causing the magnetic flux to reset to some intermediate value corresponding to the water level behind the dam. During the positive half-cycles, the electrical voltage is applied to the output winding, causing the core to saturate, analogous to the filling of the dam and its overflow. When the core saturates, the electrical voltage no longer changes the flux level, but overflow occurs and power is applied directly to the load.

* * *

Sound Moving Picture on Socket Screws

"Hold Everything" is a new 16-millimeter sound moving picture released by the Allen Mfg. Co., Hartford, Conn. This Kodachrome film illustrates why industrial distributors carry the Allen line of socket screws, points out important differences between socket screws and other types of fasteners, and stresses the particular advantages of Allen socket screws.

TOOL ENGINEERING *Ideas*

Tools and fixtures of unusual design and time- and labor-saving methods that have been found useful by men engaged in tool design and shop work

Punching, Swaging, and Blanking in a Progressive Die

By FEDERICO STRASSER, Santiago, Chile

In the manufacture of an electrical device, a component was required of the design illustrated at *A*, Fig. 1. The part had to be made from extremely soft copper sheet, 0.08-inch thick. A cold-swaging operation was necessary to reduce the stock thickness completely around the two protuberances.

In developing a production method, an experimental set of stamps was first made in order to establish the amount of stock expansion produced by swaging. These stamps did not have the irregular contour of the component itself, but instead were of a simple, almost oval shape. The expansion of the sheet in every direction was found to be considerable (approximately 0.06 to 0.08 inch in both the width and the length), and somewhat irregular. Also, center distances varied considerably.

Nevertheless, the problem was solved by creating a sufficient amount of free space around the work in the stock strip, and permitting the expanded metal to fill the space. This idea was carried out in developing a progressive die for the operation. The strip lay-out for this die is shown at *B*, in Fig. 1.

Construction details of the die can be seen in Fig. 2. In the first station, an I-shaped opening is punched to provide free space around the work. The next station is open, in order to permit strong die sections. In the third station, two stamps swage the stock that is left between the punched openings and connected to the strip by two small necks. Incidentally, with this die construction the expansion in the transverse direction has been found to be less than 0.002 inch.

In the fourth station, the part is blanked by a punch having a clearance hole for the upper protuberance. The die opening is straight-walled, not tapered as is customary in blanking dies. A spring-actuated ejector *C* at this station, which is a sliding fit in the die opening, is forced downward from its normal position when the punch blanks the part. This ejector also serves to locate the strip for the operation, it being provided with a hole to receive the lower protuberance.

The blanks are returned to the strip after being cut. This is accomplished by the combined action of the ejector and the stripper *D*, which later holds the strip down during the blanking operation. Ample punch clearance was provided to facilitate easy return of the blanks into the strip.

In addition to the regular working stop, there are three auxiliary stops *E*, as can be seen in Fig. 1, for starting each strip through the die.

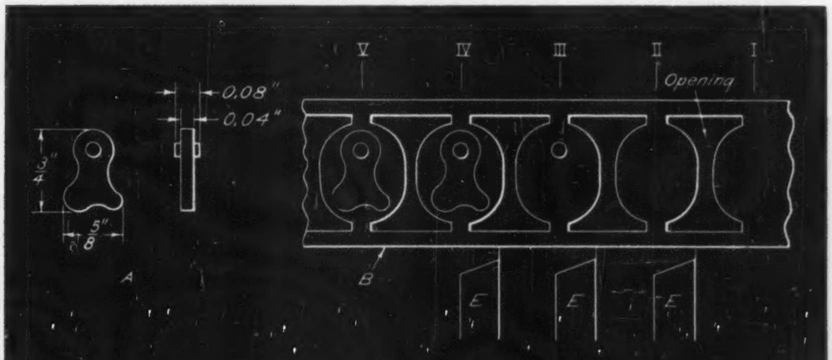


Fig. 1. Strip lay-out for a progressive die shows the sequence of the operations that produce the cold-swaged component.

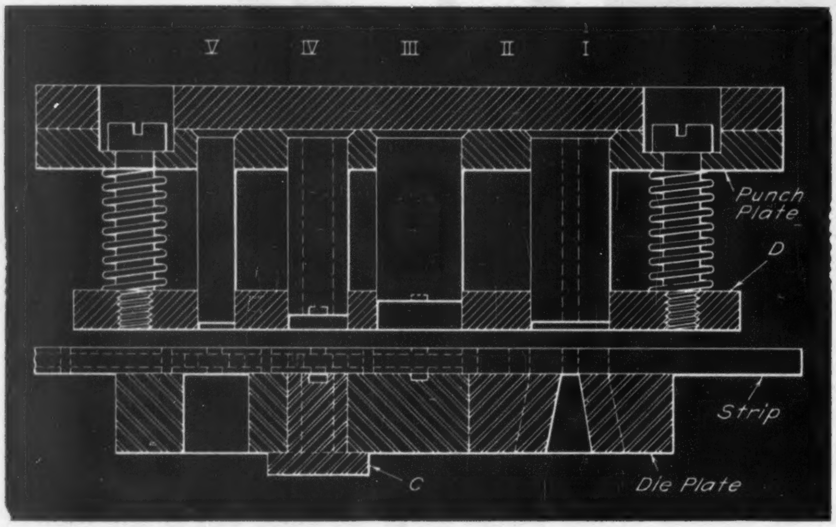


Fig. 2. Swaging is performed at the third station of the progressive die, before blanking and ejecting the part.

Finally, in the fifth station, an ejector punch pushes the finished work from the strip through an opening in the die-plate. Two limit pins (not shown) insure the correct closed height of the die set. It was found that at reduced press speed the swaging was uniform and high in quality.

Expanding Arbors Utilize Rubber Elements

By **EDWIN MOSTHAF, Mexico D. F., Mexico**

The fact that pure gum rubber is sufficiently fluid to flow, and at the same time not compressible, makes it an ideal material for use in expanding arbors. Such arbors are easy to make, run true, and grip effectively. One style, shown in Fig. 1, consists of a series of rubber bushings *A* which are located between steel spacers *B*. A split sleeve *C* encloses the bushings and spacers.

The work *D* has a slip fit over the sleeve, and is located endwise against an integral shoulder *E* of the arbor. When the nut *F* is tightened, pressure is exerted on the faces of the rubber bushings and transmitted to the inside diameter of the sleeve. In constructing this arbor, the bushings and spacers are ground to size in position, with the nut tightened just enough to cause the bushings to bulge slightly, as in Fig. 2.

For holding small work, the arbor can be designed without the split sleeve, in which case

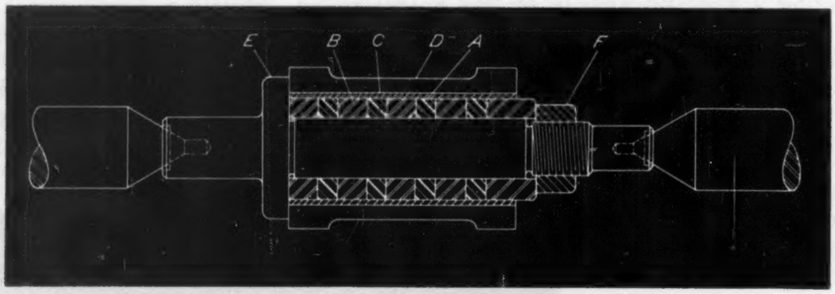


Fig. 1. Tightening the arbor nut (F) causes the rubber bushings (A) to expand against the inside diameter of the split sleeve (C).

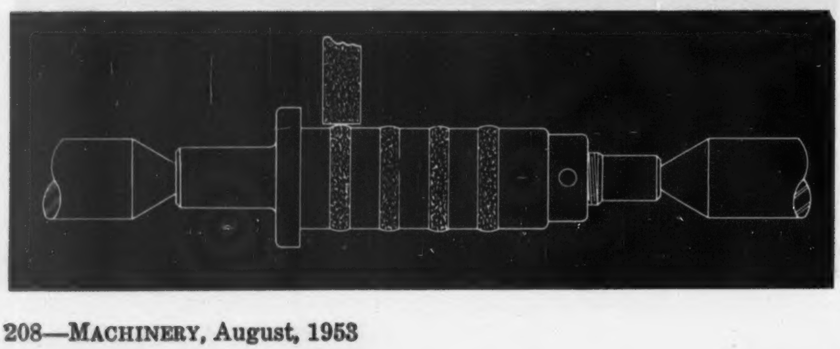


Fig. 2. In grinding the bushings and spacers to size, the arbor nut is tightened sufficiently to produce a slight bulge of the rubber bushings.

the bushings expand directly against the inside diameter of the work. The rubber used should have a Durometer value of 60 to 75. It is advisable to take light grinding cuts to avoid chatter marks in the bushings, and also to regrind the bushings periodically because of the frictional wear developed in loading and unloading the work.

An exceedingly accurate arbor uses a somewhat more plastic form of rubber in a simple hydraulic system. In this design, seen in Fig. 3, the rubber occupies an annular area *G* around the body of the arbor, and also a feeder area *H* which extends to a plunger *J*. By tightening set-screw *K*, the plunger is advanced, forcing the rubber to expand around the inside diameter of the split sleeve *L*. This arbor produces an effective grip where the tolerance of the hole in the work is held within 0.003 inch. Very little run-out is experienced.

A similar principle is embodied in the design of the chuck, Fig. 4, for holding work externally. Here, the rubber occupies an annular area *M* around a split sleeve *N* that lines the bore of the chuck. Rubber in the feeder area *O* extends to a plunger *P* which can be operated by a set-screw *Q* that is accessible from the face of the chuck.

* * *

Man-hours on a typical jet bomber have been reduced by 88 per cent from the time needed to build the first production model of the plane.

Material Available for Self-Study of Welding Design

The Lincoln Electric Co. is now releasing previously unpublished information on its system of Weldesign which constitutes a new approach to making machinery at lower cost through intelligent application of the arc-welding process. This material was developed for a nation-wide in-plant program through which over 10,000 designers and engineers have been trained. The material for self-study includes a large Weldesign manual that outlines the system step by step—giving data, charts, nomographs, tables, cost calculator, process selection guides, and time charts.

The material also includes self-study supplementary notes, a cost-calculating slide-rule, a moment-of-inertia rule, a set of weld standards on onion skin for ready duplication, and a copy of the 1300-page *Procedure Handbook of Arc Welding Design and Practice.* This entire set of material is available for $10 from the Lincoln Electric Co., Cleveland 17, Ohio.

* * *

Metals may some day be mined from oil wells, according to the Chamber of Commerce of the United States. Certain types of crude oils which are found in California contain appreciable amounts of nickel and vanadium, two metals that are in constant demand.

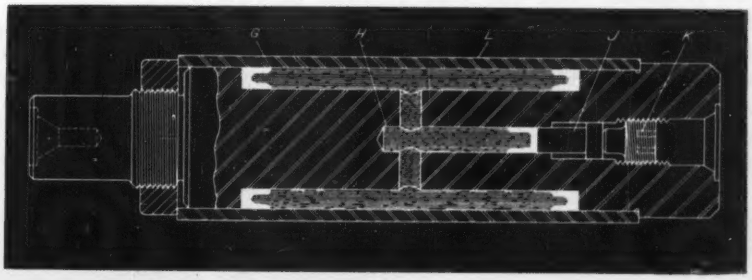


Fig. 3. The set-screw (K) has to be turned only slightly for the rubber to press against the split sleeve (L).

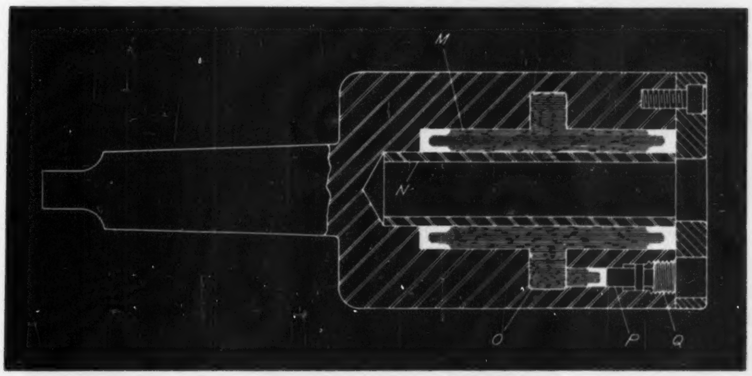


Fig. 4. Split sleeves of different internal diameter can be readily interchanged to increase the holding range of the chuck.

The Sales Engineer and His Problems

By BERNARD LESTER
Management Consulting Engineer
New York

Is Creative Selling a Lost Art?

THIS vacation season may well usher in a period of discriminating and cautious equipment buying, and equipment salesmen may now be more occupied in creating inquiries than in merely analyzing them and closing deals.

"Creative selling" to most salesmen means getting more orders for standard products than were obtained before. Backed by home office promotional support, the salesman's job is largely one of making friends and stimulating sales. It usually requires concentration on gathering a larger share of the crop, contrasted to planting the seed, cultivating the plant, and finally harvesting the yield.

Sales engineers must create orders by gaining the good will of the customer and solving his problems. But the real creation of new business, as referred to here, comes from selling an idea. It consists of transforming "decision men" of a company from persons who don't recognize or acknowledge a need, into men who do realize it and are enthusiastic over it to the point of making a profitable investment.

The technical press has done a consistently good job in picturing inefficiencies in American industry due to lack of modernization in equipment and processes. Trade associations have also played an important part. Nevertheless, plant owners and operators sometimes point with pride to ancient and stalwart machines that are actually profit thieves. Through inertia, false accounting, and lack of information they fail to recognize the increased savings that would result from replacement of obsolete equipment. The sales engineer, by focussing on a plant, person or process problem, can often transform doubt into realization and finally into conviction.

With a hungry market keeping salesmen moving from one job to the next, the job of creating inquiries has often become a lost art. On the other hand, making the grade when faced with a reduced market is a job that involves not only individual salesmen, but the company's top personnel as well—their policies and programs.

In lush times with attention fixed on pending orders, the initiative of "improved process selling" and "replacement selling" often takes a minor place. "Missionary calls" often become only a marginal duty, should time be available. The word *missionary* denotes charity or philanthropy, like a physician's services devoted to a free clinic. More appropriate is "plant efficiency calls."

These are the key points to achieve in creative selling:

For Sales Management

1. Market facts should be assembled for every salesman's territory, to identify and spotlight each prospect whose plant equipment and operations are out-of-date.

2. A definite program, follow-up, and control should exist for each sales engineer, including the use of helpful engineering headquarters' talents.

3. Sales compensation must encourage not only the closing of contracts but also plant efficiency calls to create inquiries.

4. Well-tailored literature should be developed and used. Trade paper advertising particularly should be vitalized to tell the story of profitable replacement.

For the Sales Engineer

1. Schedule plant efficiency calls as a "must." Fit each projected call into a daily schedule according to the plant location and preferred route of travel.

2. Develop an aggressive sales approach and technique, based upon rendering an engineering

service to improve efficiency. The initial step may well be to help the manufacturer get more production from the equipment he now has. The approach is not that of a red hot salesman after an order, but rather that of a capable engineer ready to study the manufacturer's problem from his profit or loss viewpoint.

3. Don't give up. At best, results are slow. But experience shows that the type of selling outlined makes devoted and rewarding customers. Nothing can approach it in building our reputation for helpfulness. We become permanent magnets that attract business.

• • •

Wire-Wrapping Tool for Solderless Connections

An estimated 10,000,000,000 soldered connections a year presently being made by the American communications industry may be eliminated by a new connecting technique now in production use by the Western Electric Co., manufacturing and supply unit of the Bell Telephone System. The method utilizes a wire-wrapping tool, jointly developed by engineers of Bell Laboratories and Western Electric, that produces an improved, lower-cost gas-tight joint between the terminal lug and the connecting wire in the assembly of electrical, electronic, and electromechanical equipment.

The lightweight tool (Fig. 1) for making solderless connections is a hand-held gun, powered either by air or electric motor, which has a rotating spindle with an axial opening that receives the wire terminal. A second opening (radially separated from the axial opening) receives the skinned end of the connecting wire. The rotating spindle of the gun wraps the wire around the terminal in a tight helix, as seen in Fig. 2, making a firm mechanical metal-to-metal joint. Automatic positioning of the spindles facilitates operation, and controlled tension permits highly uniform wraps.

A terminal, of rectangular cross-section having edges such as produced by a punch press, is wrapped with about six turns of wire under high tension. Contact pressure in the finished connection is at least 15,000 pounds per square inch for the life of the connection. The result of this high tension is an indentation of the wire at each of the four terminal corners, the indentation requiring a force of approximately 10 pounds to strip from the terminal.

Elimination of the soldering phase in assembly operations removes such disadvantages of that method as stray solder droppings and damage to adjacent parts by heat. Clipping of excess wire from a soldered connection, which is often a cause of trouble in wired equipment, is not necessary because the wire end is part of the junction. With the solderless connection, terminals can be smaller in cross-section, and spaced more closely together. Since the wrapped connection requires a minimum of space, equipment can be reduced in size. Electrical manufacturing companies will be licensed to produce the wire-wrapping tool.

Fig. 1. Hand gun, powered either by air or electric motor, is employed to produce solderless, gas-tight joint between terminal lug and connecting wire.

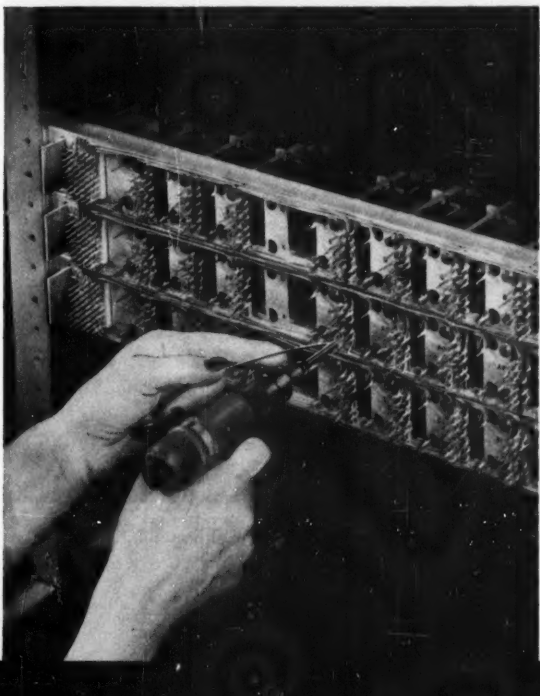
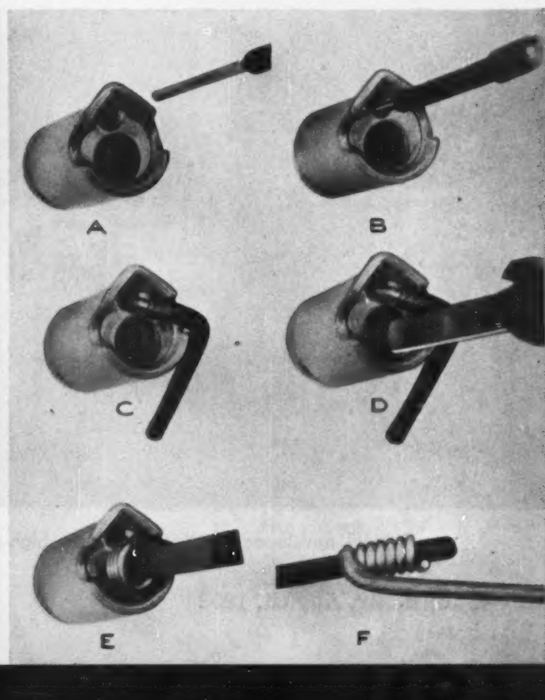


Fig. 2. Sequence of operations: (A) tool tip, (B) connecting wire inserted, (C) wire anchored, (D) terminal inserted, (E) wire wrapping, and (F) finished connection.



LATEST DEVELOPMENTS IN *Shop*

Yoder Mills Developed for High-Speed Welding of Non-Ferrous Tubing

The Yoder Co., Dept. M, 5504 Walworth Ave., Cleveland 2, Ohio, has announced the development of a process for the continuous high-speed production of non-ferrous tubes by cold-forming and welding. The first two tube mills for converting coiled non-ferrous strip stock into welded tubing by the new process have recently been completed. With these mills, induction welding of non-ferrous tubing is done at speeds ranging from 40 up to 120 feet per minute, depending on the kind and gage of metal, and the diameter of the tube.

Welds in tubes made from different grades of aluminum, nickel, and other metals, are said to show uniformly narrow weld zones with a grain structure almost unaffected by the heat. The weldable metals include almost the entire range of aluminum alloys available in coiled sheet form; certain magnesium alloys; a wide range of brasses and other copper alloys; nickel and nickel alloys, such as Monel and Inconel; also austenitic and ferritic stainless steels and the lighter gages of carbon steels, the percentage of carbon being less critical than in electrical resistance and other types of welding.

Steel tubing is being commercially cold-formed and electrically welded from sheets as thin as 0.028 inch. In the case of extruded aluminum alloys, the practical minimum thickness has been about 0.050 inch. The mills employ methods of forming that have brought the thickness-diameter ratio down to 1 per cent, and the low limit of wall thickness to 0.025 inch.

Induction welding of the non-ferrous metals is done by high-frequency current introduced through a short inductor coil as the cold-formed tube passes without contact. The current travels around the surface of the tube in the region of the inductor, then flows along the converging edges of the tube to and from a nearby point of convergence. This point is substantially beyond the field of induction and close to the center line of a set of rolls which presses the seam edges together.

As the current approaches the point of convergence of the edges, it is confined to a very shallow layer on the surfaces of the abut-

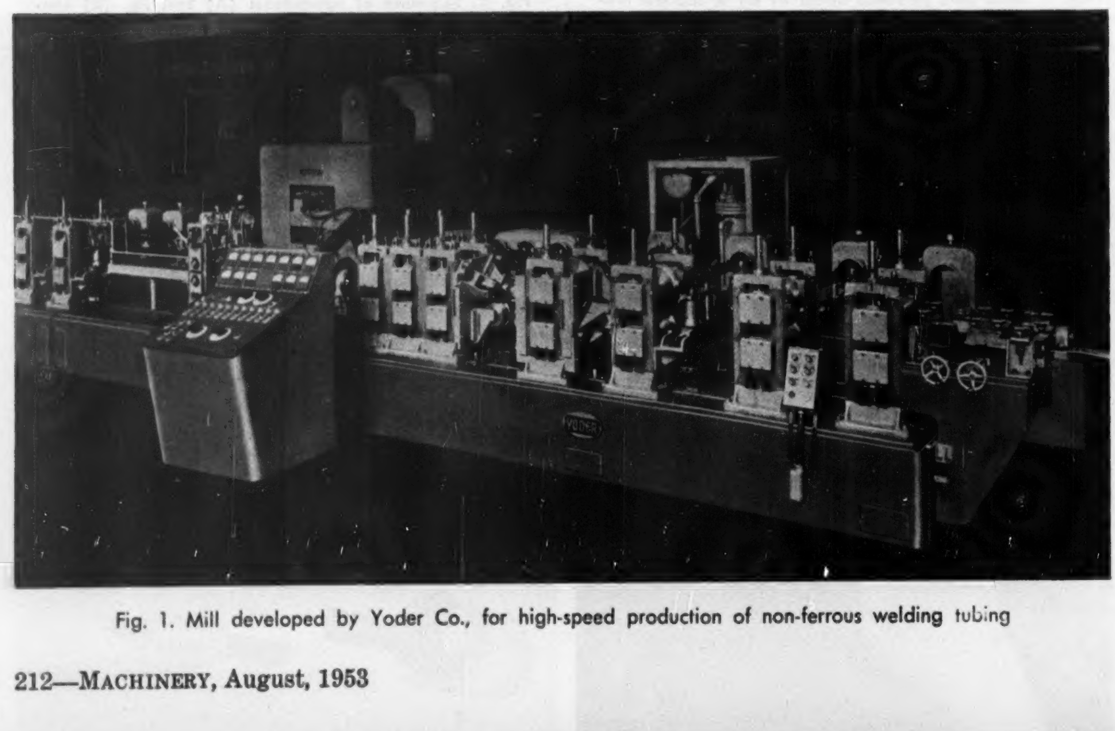


Fig. 1. Mill developed by Yoder Co., for high-speed production of non-ferrous welding tubing

Equipment

Machine tools, unit mechanisms, machine parts, and material-handling appliances recently placed on market

Edited by FREEMAN C. DUSTON

ting edges. Physical tests made on samples of Type 304 stainless steel show that the tensile strength of the metal in the weld zone is about 15 per cent higher than that of the strip from which the tubes were made. Similar results have been obtained in tests on non-ferrous metals.

Besides making tubing for conventional structural, decorative, and fluid-conveying purposes, the process is adapted for making aluminum cable sheathing used on telephone, power, and bridge cable. The process combines high speed with the advantage of continuous forming of the tubing around cable of any desired length. Thus the cable can be fed into the mill simultaneously with the strip, the latter being formed around it and welded, without injury to any covering of paper or rubber. In passing through the sizing mill, the sheathing is rolled down or "sized" to fit tightly around the cable.

The non-ferrous tube mill shown in Fig. 1 is designed to operate at speeds from 40 to 120 feet per minute, the speed depending on the gage and kind of metal to be welded. The capacity ranges from 3/4- to 4-inch tubing, in wall thicknesses ranging from 0.025 up to 0.134 inch. The illustration shows the tube forming mill at the right, and the welder with control desk to center left. Part of the sizing mill is shown at the extreme left. The strip can be seen entering the starting table at the far right. This table embodies felt wipers, pull-over and pull-under rollers, carbide-faced side guides, and a pair of adjustable edge-trimming cutters. A novel method of forming involves the use of a cluster of four edge-forming rolls between the third and fourth roll stands, and two clusters of three idler rolls between the fourth and fifth roll stands.

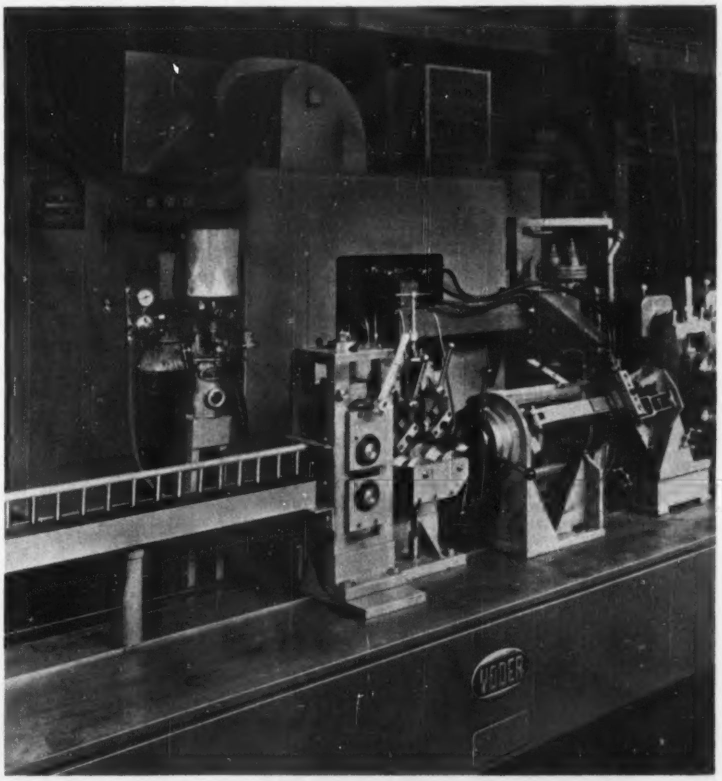


Fig. 2. Induction welder and oscillator of mill built to produce welded tubing from non-ferrous coiled stock

In Fig. 2 is shown the induction welder of a tube mill. The 50-K.W. oscillator can be seen at the rear. Mounted on the welder base at the right is the seam guide with spreader blade for holding open the top gap in the tubing to a predetermined width. Next in line are the triple-cluster squeeze rolls, and the tandem weld-flash cutters, followed by the ironing-roll stand. An inductor coil is held by an arm extending from the oscillator housing, between the spreader and the squeeze rolls.

Cemented-Carbide Twist Drill Blanks

Cemented-carbide twist drill blanks which are said to give improved performance have been announced by the Carboloy Department, General Electric Co., Box M, Detroit 32, Mich. The reduced thickness of these blanks enables the point of each drill to be strengthened by providing more steel backing for the tip. Sizes TD-1 through TD-5 are now available from stock.

"Landmaco" Heavy-Duty Threading Machine

The Landis Machine Co., Dept. M, Waynesboro, Pa., has marketed a "Landmaco" threading machine for heavy-duty precision threading of large-diameter work. This machine is of massive construction. At present, it is built only in a single-spindle model, and is furnished either with or without a lead-screw attachment. The bed is equipped with hardened and ground rectangular ways for guiding and supporting the carriage, which is gibbed to permit compensation for wear. The carriage is operated by a handwheel that actuates a rack-and-pinion mechanism.

The design of the carriage or vise is based on a new principle which is said to assure proper work alignment under gripping pressure and to give more power. This feature, combined with a hammer blow type of handwheel used to operate the grips, provides greater gripping power with less effort by the operator.

A single gear-shift lever is provided for a rapid-speed change of 25 per cent for any given spindle speed, as determined by the speed change-gears in use. Three pairs of speed change-gears provide twelve spindle speeds, ranging from 9 to 152 R.P.M. Equipment includes either the 4-inch standard rotary head or the new 6-inch, six-chaser "Lanco" head. Both die heads are of sturdy construction and provide a rigid support for the chasers.

The machine will cut bolt threads from 1 1/2 to 6 5/8 inches in diameter, and pipe threads from 1 to 6 inches in diameter up to 29 inches long when using the lead-screw, and 30 inches long without the lead-screw. From 2 to 24 threads per inch can be cut with the regular equipment available.

Snyder Special Machine for Processing Aircraft Parts

A special automatic double-end machine for use in processing aircraft landing-gear cylinders of alloy steel has been brought out by the Snyder Tool & Engineering Co., Dept. M, 3400 E. Lafayette, Detroit 7, Mich. Processing operations on the cross-shaped workpiece include rough-machining, heat-treating, and finish-machining. The machine consists of two double-end sections placed side by side. The part is manually loaded and clamped in the fixture, after which the fixture is loaded into one machine section and power clamped in position.

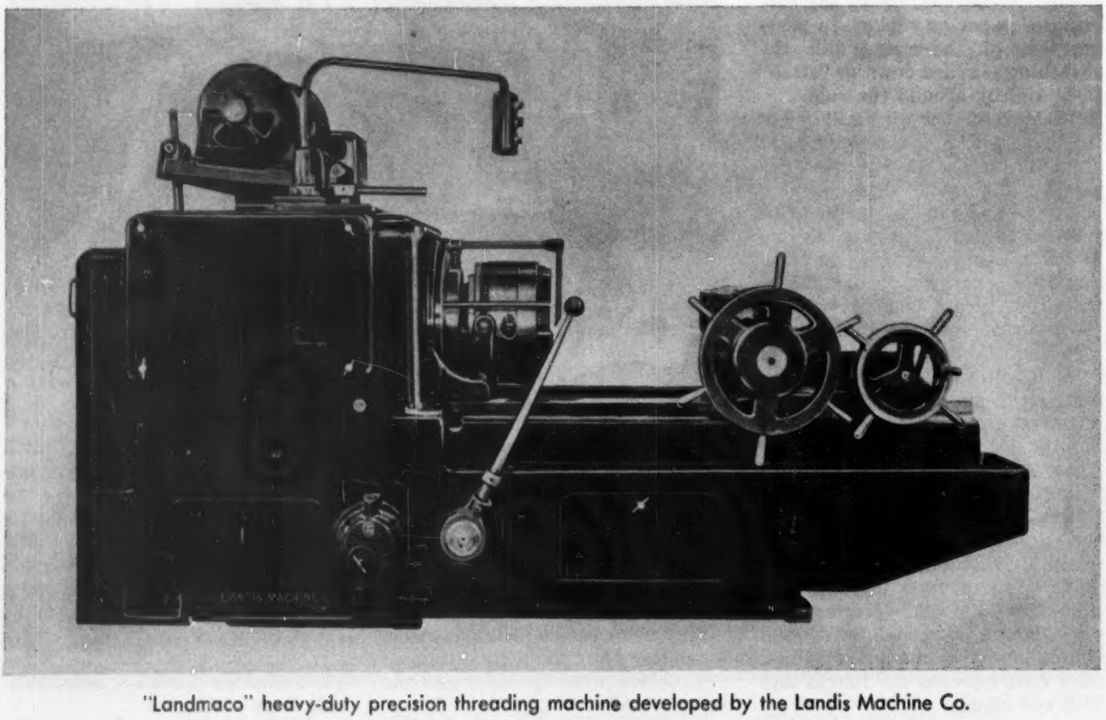
The operator selects the proper tools and uses them in the required sequence, alternating from one end of the part to the other, so that while an operation is being performed on one end, he is changing tools for the subsequent operation on the other end.

The two trunnion ends are hollow-milled and centered, and the two cylinder ends are bored, faced, and centered. Carbide and high-speed steel tools are used. Two opposite ends of the part are processed in one section, following which the fixture is transferred to the second machine section where the other two opposite ends of the part are processed.

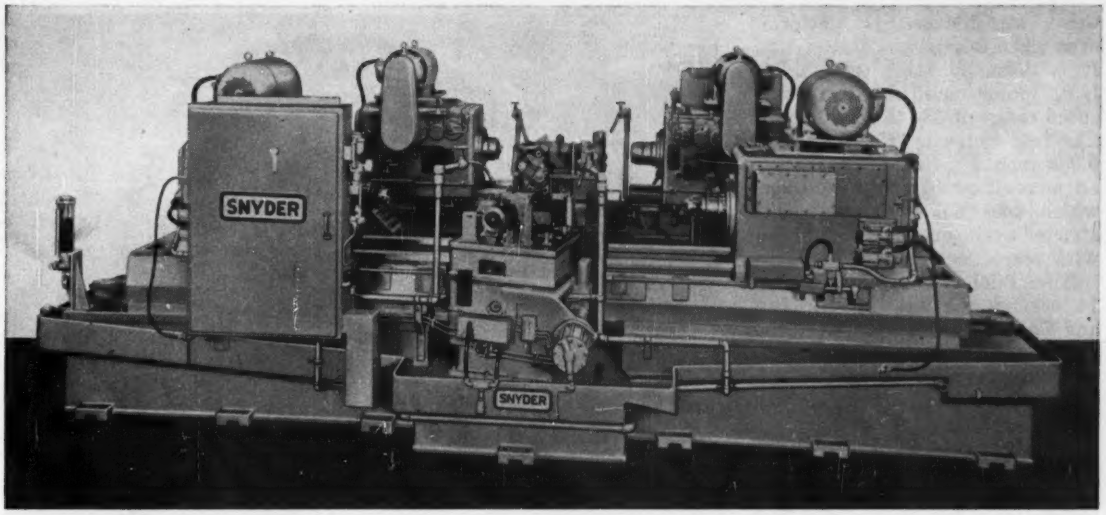
Each unit is controlled separately, and the work cycle is automatic. Pressing a button causes the motors to start and the head to be rapid-traversed until the feed switch is contacted. The unit then feeds to depth and automatically returns to the starting position.

Feed start dogs and positive stops for the heads are selected through a rotating rail and a movable end-stop. The spindle noses in the head are provided with a quick-change lock for holding the various tools.

The heads are provided with eight spindle speeds ranging from



"Landmaco" heavy-duty precision threading machine developed by the Landis Machine Co.

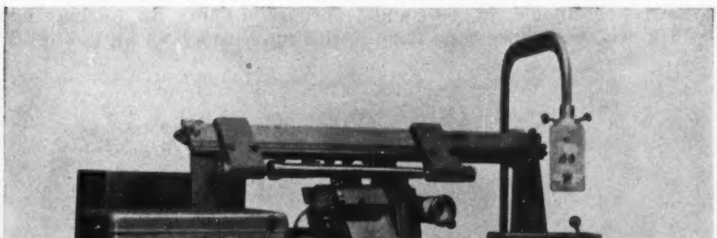


Snyder double-end machine for processing aircraft landing-gear cylinders

43 to 416 R.P.M. The two-lever shifting mechanism is interlocked so that the gearing cannot be damaged by incorrect positioning of the levers. The units have a maximum stroke of 30 inches and a feed rate of from 1/2 inch to 30 inches per minute. The units on one section of the machine are also provided with attachments for step-drilling deep holes in the trunnion section of the part. Each section has a hydraulic tank and pump as well as its own hand-operated, centralized lubrication system. The base and column of the machine are of welded-steel construction, reinforced and thoroughly normalized. Production rates vary with handling facilities and operator skill.

Automatic Hydraulic Copying Lathe

A "Pilote" automatic copying lathe with hydraulic carriage feed has just been introduced in the United States and Canada by H.E.B. Machine Tools, Inc., Dept. M, 475 Fifth Ave., New York 17, N. Y. It is only necessary to load the machine and press a button to start the machining cycle. When the part is finished, the tool returns to its starting position and the spindle stops automatically.



"Pilote" automatic copying lathe introduced by H.E.B. Machine Tools, Inc.

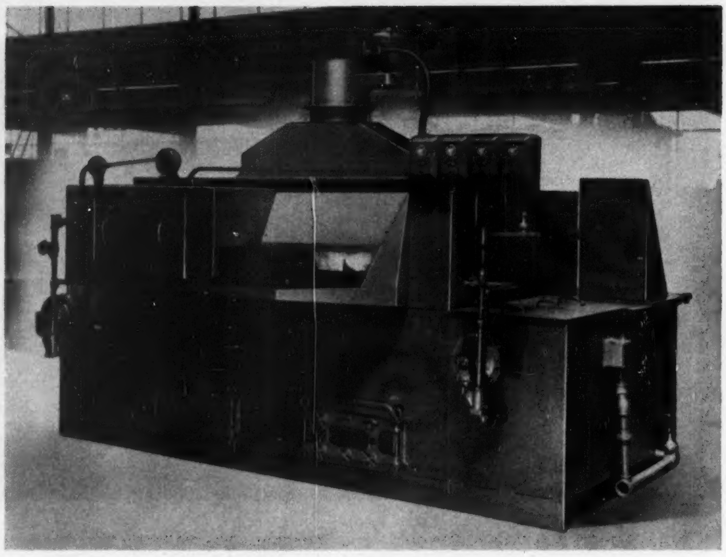
One unskilled operator can feed several of these machines. The set-up can be completely changed in less than an hour. Both roughing and finishing can be done at the same time by utilizing one or more tools. The machine is equally suitable for first or second operations, for chucking operations, or for boring and outside turning in the same operation.

The cross-slide can be provided with slots to permit using both front and back tools, as well as a boring-bar. Its transverse motion is controlled hydraulically by the copying device, following a flat template fixed in an indexing drum designed to carry a maximum of eight different templates. The front and back tools may both be used for copy turning, using a different template for each cut. The back tools can also be arranged for plunge-cutting automatically and for light finishing cuts, employing a Z-stop that enables tolerances of 0.0005 inch to be maintained on production runs. A surface finish of better than 32 micro-inches is said to be easily maintained.

The machine can be fitted with one or two infeed attachments when required for under-cutting or facing. The hydraulic feed of

these attachments is uniform, even when taking very heavy cuts. It is normally fitted with a 20-H.P. motor and has a spindle speed range of 380 to 3000 R.P.M. The feed range is from 0.0015 to 0.035 inch. Provision is made for an ample flow of cutting coolant which does not need to be restricted as the machine is equipped with very effective splash guards.

The "Pilote 51" will swing work 14 inches in diameter over the bed and 7 inches in diameter over the cross-slide. The maximum distance between centers is 30 inches. The spindle bore is 2 inches. A bar feed attachment is available. A larger machine—the "Pilote 76" —will swing work 15 3/8 inches in diameter over the bed and 8 1/4 inches over the cross-slide. The spindle bore of this machine is 3 inches. This model is designed to take motors up to 60 H.P. to provide sufficient power when fitted with two cross-slides and two infeed attachments. Drills and boring-bars may also be used in the tailstock of the machine, in which case a hydraulically operated feed can be employed.



Turntable machine for washing metal parts built by G. S. Blakeslee & Co.

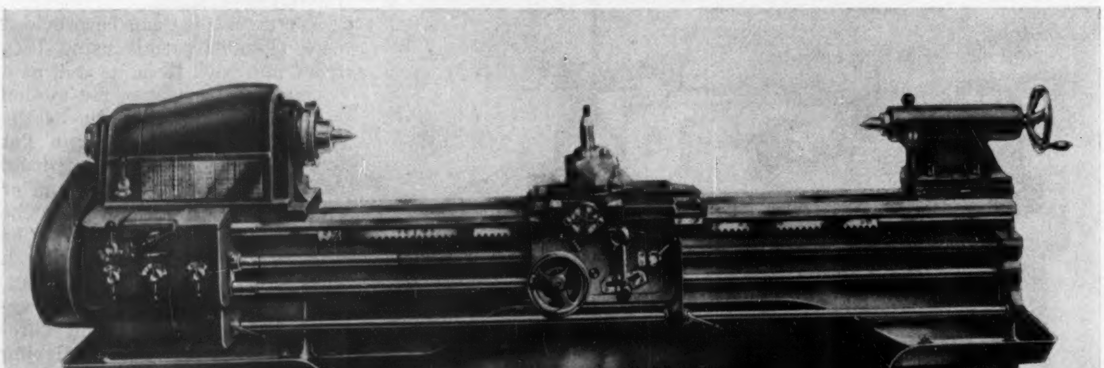
Simplex Gap Bed Lathe

The Morey Machinery Co., Inc., Dept. M, 410 Broome St., New York 13, N. Y., has announced a Simplex 20-inch lathe that is said to be especially suited for accurate job shop work. Several new features have been incorporated in this comparatively heavy lathe to increase its versatility and usefulness. The hardened and ground spindle has an American standard nose, and the ground lead-screw is provided with a split nut to eliminate backlash.

One of the outstanding features of this lathe is the gap bed with a reinforced removable block type gap that increases the swing to 30 inches. A gear-box fitted with splined shafts and a shear-pin safety device gives a full thread-cutting range for both American and metric standard threads. The lathe is obtainable in 60- and 78-inch center-distance capacities.

Turntable Type Washing Machine

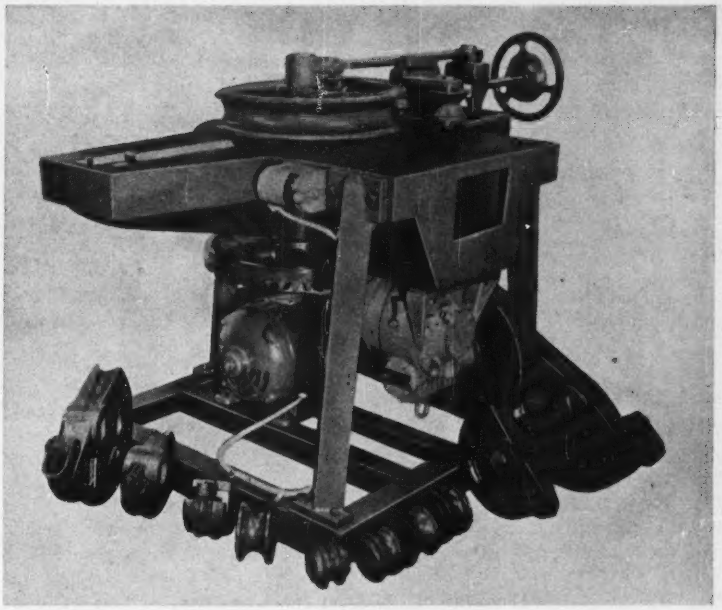
A machine for washing metal parts that incorporates several interesting features developed to conserve space and obtain more economical operation has been brought out by G. S. Blakeslee & Co., Dept. M, 19th and 52nd Ave., Cicero Station, Chicago, Ill. The machined work to be cleaned is placed in baskets or in special fixtures that ride on a turntable. The turntable takes the work through a spray for washing and rinsing, through an air "blow-off"



Simplex lathe incorporating new features announced by Morey Machinery Co., Inc.

section, and then brings the cleaned parts back to the loading and unloading station.

This unit is available in a wide variety of sizes. Motor-driven pumps circulate the washing and rinsing solutions. Compressed air for the blow-off section is taken from the regular shop line. An automatic trip mechanism turns the air on for only a brief period as the work passes through the blow-off section. The correct operating temperature is maintained by a thermostatic control valve in the heating line. This equipment can be furnished for operation with steam or gas, and can be of a special explosionproof construction for use with petroleum solvents.



Power-operated pipe-bending machine recently brought out by the American Pipe Bending Machine Co.

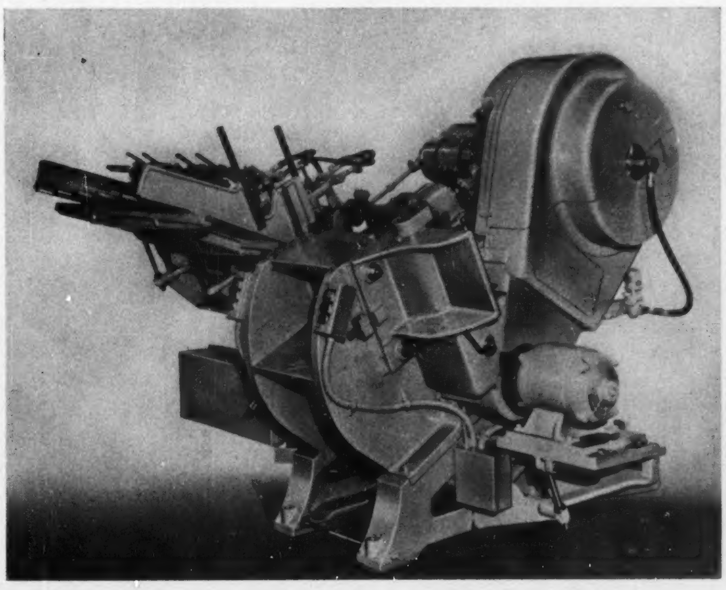
Power-Operated Pipe-Bending Machine

The American Pipe Bending Machine Co., Dept. M, Poultney, Vt., has recently added a power-operated machine to its line of pipe-bending equipment. This 2PBR machine is designed to bend 1/2-inch to 2-inch U. S. standard pipe to radii approximately five times the pipe size, to any angle up to 180 degrees. The maximum radius of bend which the machine will make is 13 inches. The machine will bend up to 1 1/2-inch extra heavy and 1 1/2-inch double extra heavy pipe.

The complete unit includes a standard 2-H.P. motor and drum type reversing controller, as well as all rollers and quadrants for the fixed radius bends available within the capacity of the machine. The packed unit weighs approximately 1500 pounds.

Hamilton Strip Feed Press

The No. 401 strip feed press built for high-speed production of can ends, screw caps, and other light stampings has recently been redesigned by the Hamilton Division, Baldwin-Lima-Hamilton Corporation, Dept. M, Hamilton, Ohio. The continuous feed stack now available on this press provides for a production run of at least one hour before reloading. The rated capacity of the machine is 25 tons.



Strip feed press recently redesigned by the Hamilton Division of the Baldwin-Lima-Hamilton Corporation

Other features include an improved frame design of welded-steel construction, which is said to maintain accurate alignment without tie-bars. A Fawick Air-Flex clutch and brake mounted directly on the crankshaft assures smooth starting, protection for the crankshaft and dies, and practically instantaneous stopping. Sectional type friction shoes in the clutch, applied by an air-inflated tube give uniform pressure around the drum, eliminate the possibility of improper adjustment, and automatically compensate for wear.

Operation of the adjustable vacuum cut-off has been speeded up and simplified. The air supply line is completely closed before the short lines to the vacuum cups are opened to the atmosphere to break

the vacuum. This unit operates in conjunction with the cross-feed which takes the strips from the suction cups into and under the finger-bar in the table. The press operates on its own built-in vacuum system, or on any regular shop system.

Safety for the operator is provided through controls that require the use of two hands, and an open electric circuit when the flywheel guard door is open. Automatic lubrication is optional.

Ceco Gravity Drop-Hammer

A 6000-pound "Ceco-Drop" hammer has just been completed by the Chambersburg Engineering Co., Dept. M, Chambersburg, Pa., for the Steam Turbine Division of the Westinghouse Electric Corporation. This machine will be used with four other "Ceco-Drop" hammers ranging in size from 2500 to 5000 pounds, in forging steam turbine blades. It is the largest machine of its type built by the manufacturer.

An outstanding feature of this machine is the piston-lift, gravity drop design which removes the limitations of size common to the board drop-hammer and extends the range of falling weights that is practical for gravity hammers.

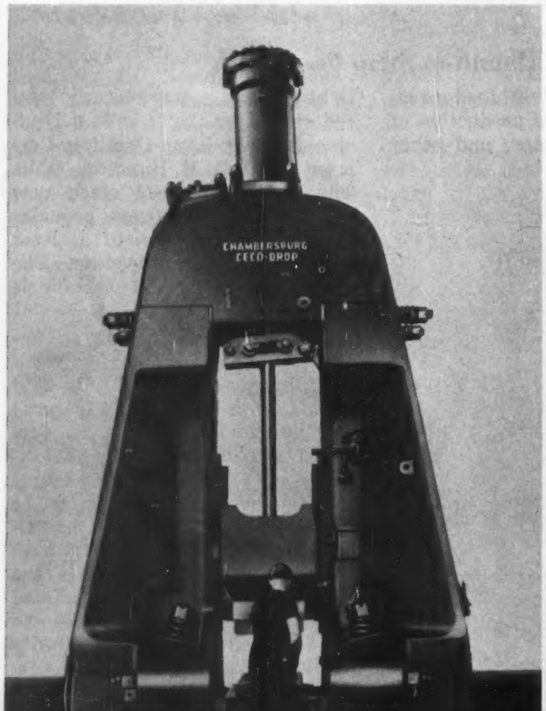
Swanson Turret Indexing Units

A line of standard, intermittent motion, turret indexing units, built to provide a basic "packaged" chassis for a wide variety of special automatic machines, has been announced by Swanson Tool & Machine Products, Inc., Dept. M, Erie, Pa. These units are designed to eliminate a large part of the engineering time and cost required in designing special machines for light manufacturing operations on small and medium-sized parts. They are offered with turret diameters of 20, 30, or 40 inches, for mounting sixteen, twenty-four, or thirty-two work stations. Indexing rates range from 547 to 4700 per hour, and the dwell time may vary from 0.5 second to 4.9 seconds.

Indexing movements are accomplished smoothly by a cross-over cam. A locking device assures positive and accurate location at all work stations. A ring with a radial keyway is provided below the face of the turret for fastening mounting brackets. These brackets may be fastened in any position around the turret. They are furnished in a variety of widths to support any type of operational device. The stationary center plate, recessed in the top of the turret, provides additional mounting space. Floor baseplates can also be furnished for mounting larger apparatus. A fabricated steel base rigidly supports the index box and turret and encloses the motor drive.

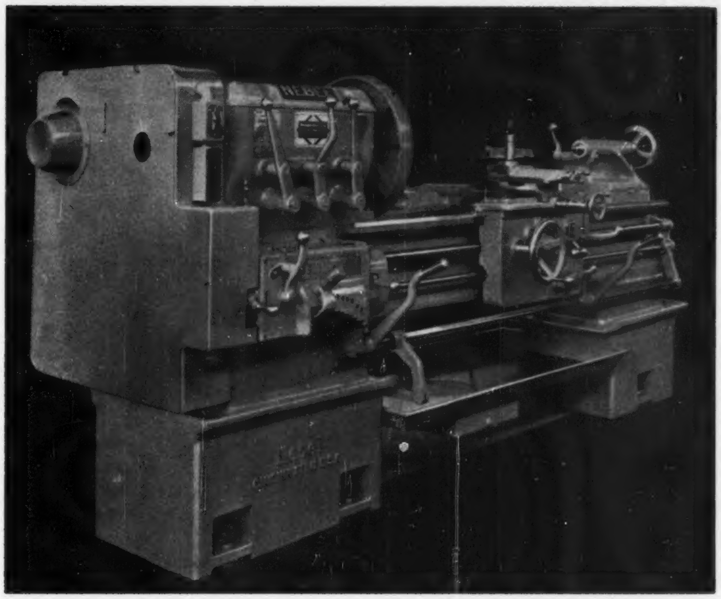
Nebel Medium-Duty Lathes

The Nebel Machine Tool Co., Dept. M, Cincinnati 25, Ohio, has announced the modification of its 16-inch swing 'LN' series engine and removable block gap lathes. Improvements include a quick-change gear-box in place of the semi-quick type incorporated in previous models. The standard gear-box provides for thirty changes in feed and twenty-eight changes for thread cutting. With



Chambersburg "Ceco-Drop" hammer of large size

Swanson turret indexing unit for automatic machines



Modified medium-duty lathe built by the Nebel Machine Tool Co.

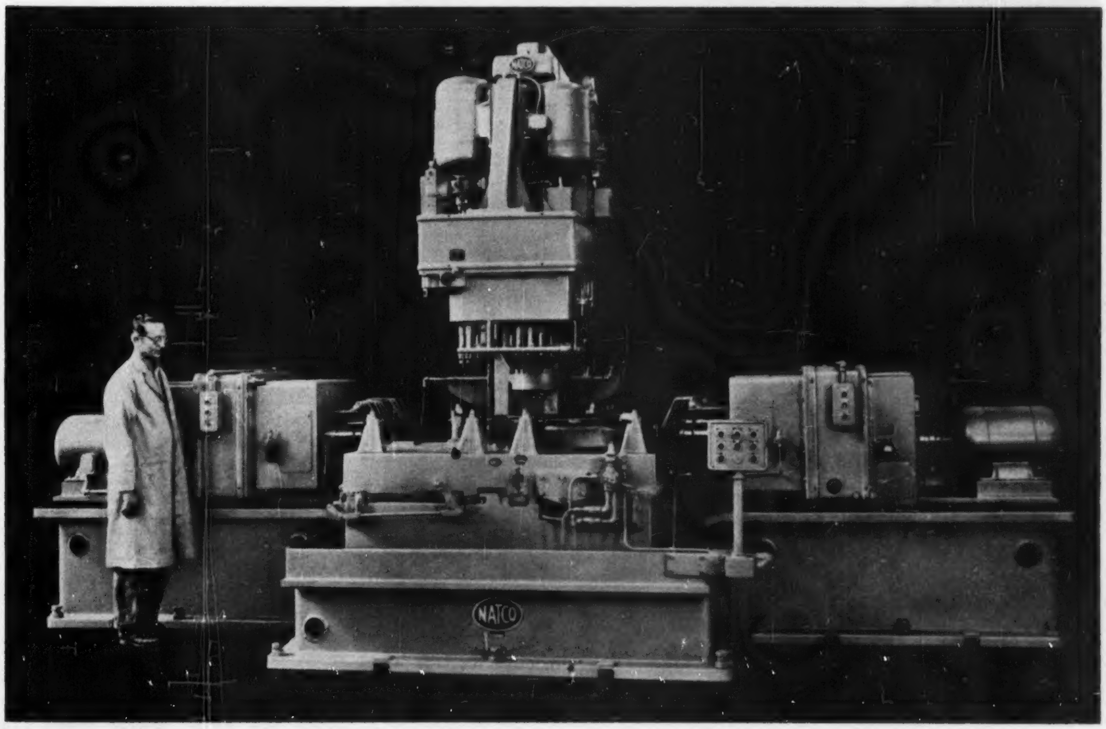
compounding gears, forty-eight feed changes and forty-six thread changes are available.

The modified machines have heavier aprons and carriages, and are arranged for a single- or two-speed 5- to 7 1/2-H.P. main-drive motor. The lathes now have cabinet type legs and end covers that conform to the contour of the headstock and quick-change gearbox. Optional equipment such as shaved and hardened headstock gears, hardened steel bedway inserts, and hydraulic duplicating attachments are now available.

Automatic "Holetapper" and Driller

An automatic tapping and drilling machine for right- or left-hand parts used on defense equipment has been announced by the National Automatic Tool Co., Dept. M, Richmond, Ind. Left-hand parts are removed and loaded at the first position for processing by the left-hand horizontal and vertical heads. In the third position, the vertical head taps four holes and the left-hand horizontal head the same number. At the second position, the vertical head remains idle while the left-hand horizontal head performs the tapping operations in three holes.

The right-hand horizontal and vertical heads are arranged to perform the following operations on right-hand parts: the parts are removed and loaded in the first position; at the third position, the vertical head drills eight holes and the right-hand horizontal head taps four holes; and in the second position, eight holes are tapped by the vertical head, and three holes are tapped by the right-hand horizontal head. Each cycle is automatic and controlled through push-buttons by one operator.

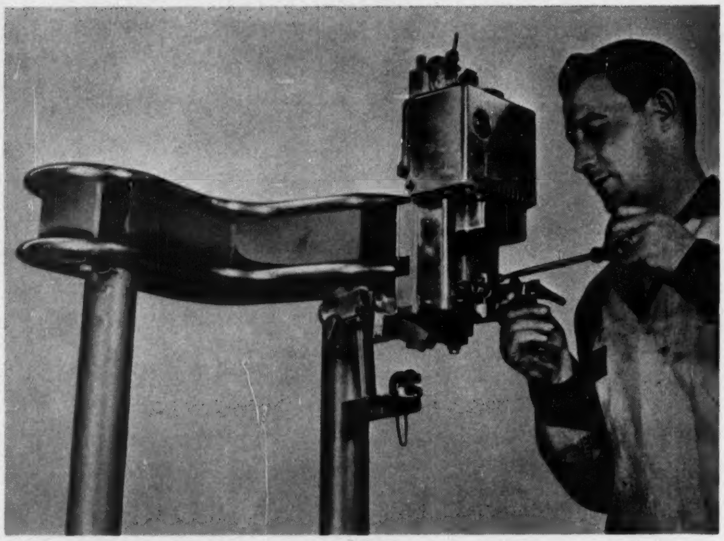


Drilling and tapping machine for right- and left-hand parts announced by National Automatic Tool Co.

Elmes Hydraulic C-Frame Press with Two Rams

American Steel Foundries, Elmes Engineering Division, Dept. M, 1150-J Tennessee Ave., Cincinnati 29, Ohio, has brought out a double-ram hydraulic flanging press so designed that both cylinder assemblies can be operated in unison, providing a total frame capacity of 600 tons, or each 300-ton cylinder assembly can be operated as an individual press unit independently of the other, to suit any specific job.

Power for each cylinder is supplied by an individual hydraulic pump. Either or both pumps can be operated, depending on whether the press is being used as a single ram press or as a dual-ram press. Control is provided through a swivel-mounted single pendant type station.



Flame-cutting equipment made by the Milwaukee Shipbuilding Corporation

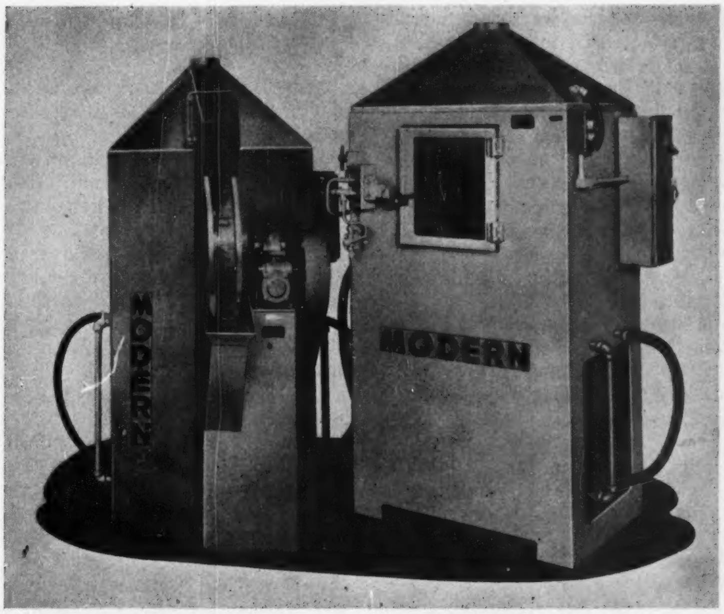
Elmes double-ram hydraulic flanging press

Three-Dimensional Flame-Cutting Equipment

The Milwaukee Shipbuilding Corporation, Dept. M, 3718 W. Lancaster Ave., Milwaukee 9, Wis., has placed on the market "three-dimensional" flame-cutting equipment for scarfing the edges of curved metal pieces in preparation for assembling large units by welding.

Semi-automatic "3-D" equipment, such as shown in the illustration, has a flame cutter which moves under power as it follows the curves of the metal under process. The cutting flame slants at a constant angle from the desired apex of a scarfed edge. A system of twin rails is employed, the rise, fall, tilts, and turns matching those of the metal under process. Four spring-loaded driving rollers and a spring-loaded idler guide the unit along the true path of the rails. The driving rollers move at speeds up to 15 inches a minute, powered by a 1/25-H.P. electric motor. One of the rollers in the drive group is serrated to prevent slippage when the unit enters a curve, where control must be absolute to avoid deviations.

Rails can be built in a complete circuit, if the job so requires, or in any portion of a circuit to guide the unit up, down, and around. It has been found advisable, however, to avoid cutting upward at an angle of more than 22 degrees in order to keep falling slag away from the head. Metal from 1/4 inch to 8 inches thick can be cut.



"Maizo" blast machines built by the Modern Industrial Engineering Co.

Werner Knee Type Vertical Milling Machine

A Werner 40-H. P. knee type milling machine which is adapted for use in tool-rooms as well as production lines, is being introduced in this country by Marac Machinery Corporation, Dept. M, 1819 Broadway, New York 23, N. Y. Pre-selectors make possible push-button control of forty-two speeds and fifty feeds. The speeds range from 16 to 1800 R.P.M., the feeds from 3/16 inch to 80 inches per minute.

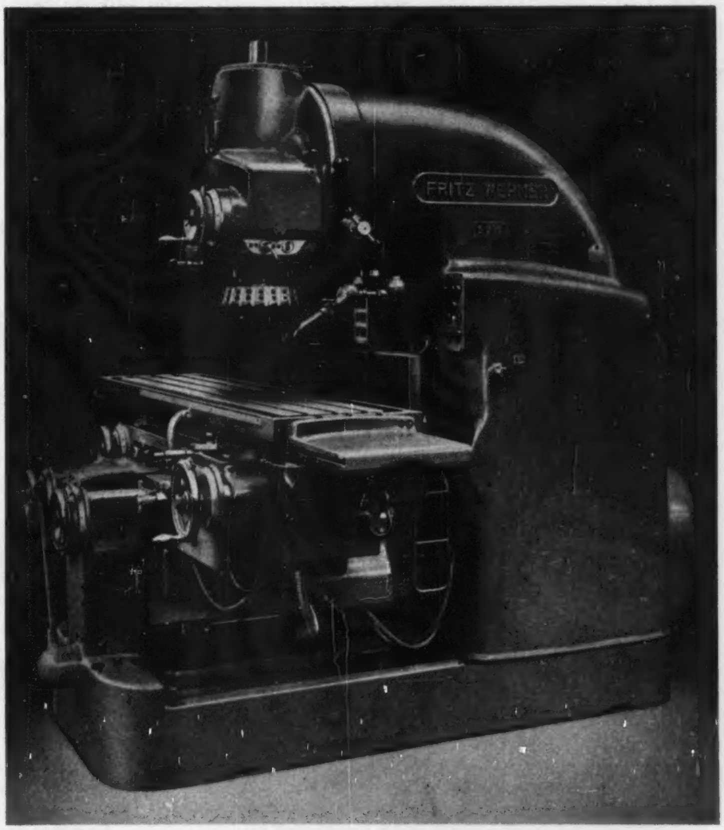
Hydraulic cylinders operated by solenoid valves shift the gear clusters as required to obtain the desired speed. Limit switches are so arranged that the spindle cannot be restarted until the gears for the pre-selected speed have been correctly engaged. During the shifting operation the gears are revolved slowly by an auxiliary motor in order to insure accurate, smooth engagement of the hardened and ground teeth. The changes in feed are obtained by means of electromagnetic clutches. A different feed can be selected

"Maizo" Blast Machines for Deburring Soft Metal Parts

Fast deburring of soft metal parts is possible with two "Maizo" blast machines developed by the Modern Industrial Engineering Co., Dept. M, 14230 Birwood Ave., Detroit 4, Mich. A Model MA-24 machine, using a continuous rotating process is employed for small parts, and Model MA-1 machine with a stationary clamping arrangement for larger units. Both machines are designed to remove light burrs from metals in the hardness range from aluminum to mild steel. Maize, or a similar soft material, is blasted against the parts under factory air-line pressure. These machines are specially suitable for deburring parts that would be damaged by tumbling.

A Ferris-wheel type fixture rotates continuously between two reciprocating blasting guns in the Model MA-24 machine at the rate of approximately one revolution every five minutes. The revolving wheel carries sixteen to twenty-four pieces in holding wires bent to suit the part, and has a production rate up to 288 pieces per hour, depending on the size of the part.

Parts that are too large to be handled effectively on the continuous machine can be deburred satisfactorily in the Model MA-1 machine. This machine has a stationary unit in which parts rotate on a fixed axis in a fixture. A single 1/2-H.P. motor and speed reducer supply power for the unit.



Werner push-button controlled vertical milling machine

and engaged while the machine is cutting.

Other features now provided on this machine include an automatic rise and fall device for the knee that lowers the table for the return traverse; automatic table clamping and unclamping arrangements; permanent indicators that show the feed, speed, and direction of traverse for which the controls are set; automatic lubrication; and a built-in climb-milling device.

At the end of the feed stroke, the table automatically drops 2 inches, and at the end of the rapid return movement rises 2 inches. For single-piece work the controls can be actuated manually.

Electrohydraulic clamps automatically prevent movement of the table in any direction unless a feed is engaged. When a feed is engaged for table movement in a given direction, the clamp that normally prevents movement in that direction is automatically released.

The No. 5 milling machine has a table 90 by 19 1/2 inches and a longitudinal traverse of 55 inches. The No. 6 machine has a table 110 by 19 1/2 inches. A plain milling machine of similar dimensions is also available.

Cleveland Straight-Sided Double-Crank Press

A straight-sided double-crank press with double-geared, twin drive has been brought out by the Cleveland Punch & Shear Works Co., Dept. M, Cleveland 14, Ohio. The press is equipped with a two-station electrically controlled air-operated drum type clutch with spring-loaded brake. It is designed with an air counterbalance for the slide, and the flywheel is provided with an auxiliary air brake to bring it to a quick stop when the power is shut off.

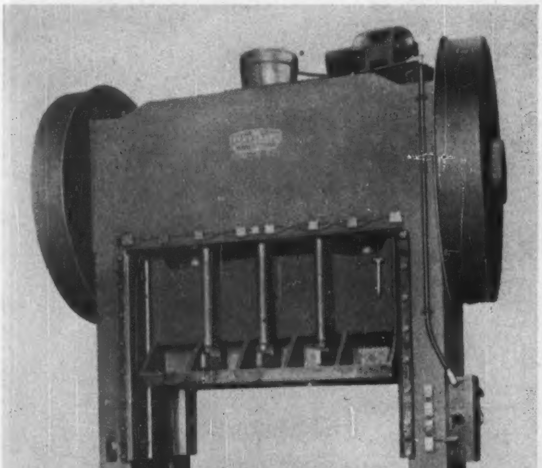
The bed of the press is arranged with a 91-ton pneumatic cushion made in two units, with manifold controls, so that the cushions can be operated independently of each other.

The press has a stroke of 16 inches and a slide adjustment of 12 inches. The distance from bed to slide is 32 inches with the stroke up and adjustment down. Bed and slide space is 60 by 96 inches, and the rated capacity of the press is 525 tons. The gears run in a bath of oil and the drive is designed to transmit power through multiple V-belts from motor to flywheel.

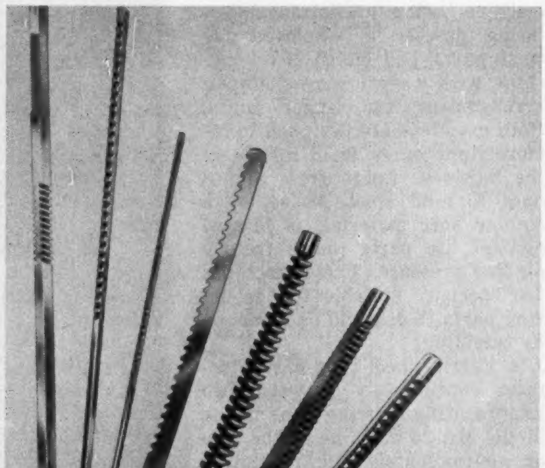
Broaches for Special Applications

The du Mont Corporation, Dept. M, Greenfield, Mass., is now supplying a wide range of special broaches, a few of which are shown in the illustration. The broaches in this line are limited to those having cutting sections of 20 inches or less and an overall length of 36 inches or less. Square broaches not smaller than 1/4 inch across flats are included. Round, spline, or irregular-shaped broaches are not included.

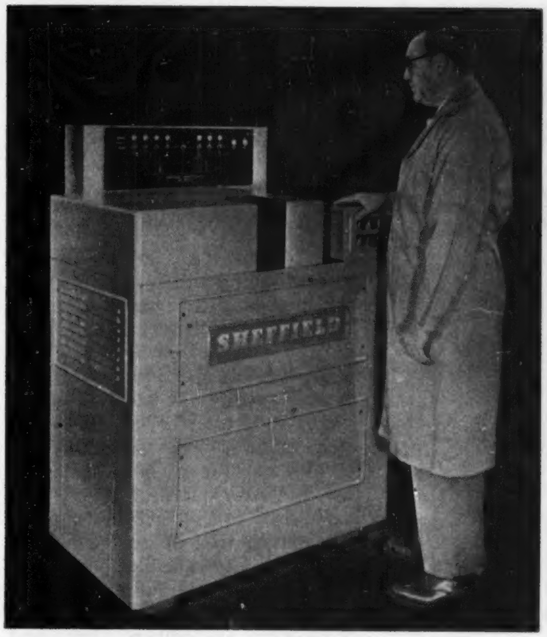
The broaches shown in the illustration reading from left to right are: (1) Pull type broach for sizing width and depth of slot in one operation: (2) pull type keyway broach of single-pass type; (3) another pull type, single-pass keyway broach; (4) keyway broach for use in Davis and similar type keyseating machines; (5) push type square broach, with round pilot; (6) push type broach for squaring both ends of an elongated hole in one operation; (7) push type production keyway broach of self-supporting, single-pass type; (8) push type square broach, with round pilot; and (9) push type broach for sizing four sides of a rectangular hole in one operation.



Straight-sided double-crank press announced by Cleveland Punch & Shear Works



Broaches for special applications now available from the du Mont Corporation



Sheffield inspecting and segregating machine for small-caliber ammunition

Multi-range test chamber has been brought out by Murphy & Miller, Inc.

Automatic Gaging Machine for Small-Caliber Ammunition

A gaging machine designed for fully automatic inspection and segregation of 30-caliber ammunition is being manufactured by the Sheffield Corporation, Dept. M, Dayton 1, Ohio. This compact, self-contained gage is only 40 inches long, 30 inches wide, and 57 inches high. It has a single split-gage station, and is built to inspect 3600 units per hour. Each complete round is checked for profile and alignment, six dimensions, and weight. At the same time, the machine automatically segregates the rounds into four classes: acceptable; rejected because of dimensions; overweight; and underweight.

Multiple gaging is done at one station with Sheffield "Electrichek" gage heads. The shell drops into a split-chamber gage head where it is checked for profile and alignment, head to shoulder, overall length, extractor groove diameter, primer depth, head diameter, and head thickness. If any of the dimensions are faulty, the round is rejected before it is passed to the second, or weighing, station where it is checked to a weight tolerance of 20 grains.

The machine is set up with maximum and minimum masters. Individual lights corresponding to the gaging points facilitate the set-up. For dimensions within the required tolerance, the lights go out. If one or more dimensions are not within the required tolerance, a red or green light indicates a plus or minus condition.

Multi-Range Test Chambers

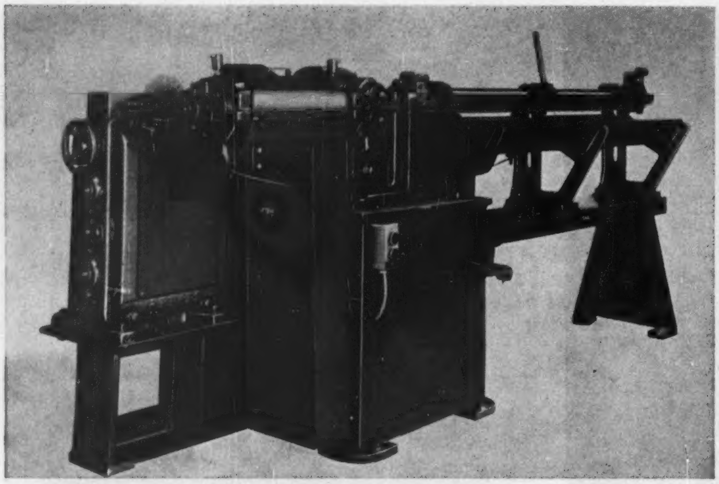
A line of multi-range, all-purpose test chambers capable of producing temperatures as low as −130 degrees F., and as high as 200 degrees F., and a standard humidity cycle of 20 to 95 per cent from 35 to 185 degrees F., has recently been introduced by Murphy & Miller, Inc., Dept. M, 1326 S. Michigan Ave., Chicago, Ill. This line of test chambers includes five sizes with test space capacities of from 4 to 36 cubic feet. Many features designed to provide faster, easier, and more accurate testing are incorporated in these units.

Included as standard equipment are four sleeved openings with inside diameters of 5/8 inch that permit the introduction of electrical leads and hydraulic lines. Another feature is an electric defrosting system complete with safety controls. Optional features such as a program control, a recorder-controller, electrical terminal pads, hand-hole ports, and a glass viewing window, are available with the units.

Hydraulic Gap Type Press

A Model 220G hydraulic gap type press designed for jobs that require the application of accur-

Studebaker hydraulic gap type press

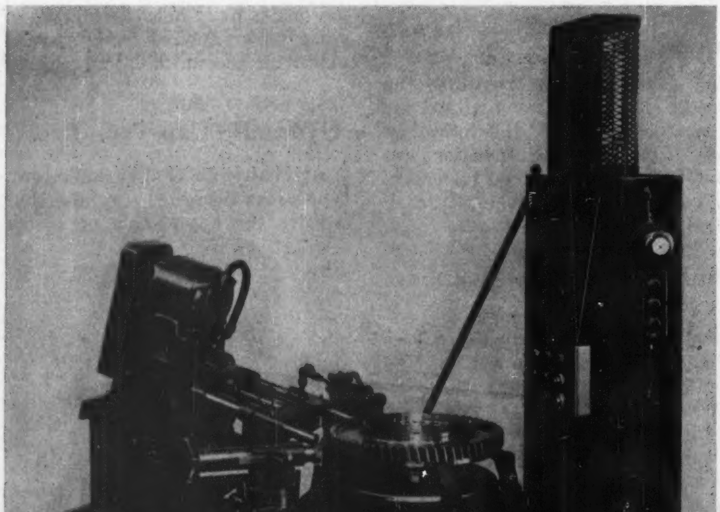


Shuster automatic wire straightening and cutting machine

ately predetermined pressures of up to 20 tons has been announced by the Studebaker Machine Co., Dept. M, 1221 S. 9th Ave., Maywood, Ill. This press is especially adapted for rapid operation on forming, drawing, bending, forcing, straightening, riveting, upsetting, piercing, crimping, and staking jobs. The rapid ram speed and stroke control can be provided to suit customers' specifications. The press has a 10-inch gap, a 12- by 17- by 2 1/2-inch platen, and is equipped with pressure gage and adapter.

Shuster Automatic Wire Straightening and Cutting Machine

A Shuster 1AV automatic wire straightening and cutting machine has been added to the line manufactured by Mettler Machine Tool, Inc., Dept. M, New Haven, Conn. The variable-speed drive of this machine provides stepless speed changes from 50 to 200 feet per minute. The machine will straighten and cut both basic and spring wire, handling basic wire from 3/32 to 1/4 inch in diameter and spring wire up to 1/8 inch in diameter. The variable-speed drive is said to enable the operator to compensate for differences in the wire such as temper, alloy, and size, and yet maintain peak production.



Avey machine equipped with "Electrodex" indexing table

Avey Indexing Machine Designed for Drilling and Tapping Jet-Engine Parts

The Avey Drilling Machine Co., Dept. M, Cincinnati 1, Ohio, has announced an automatic indexing machine designed primarily for drilling and tapping parts for jet engines.

The "Electrodex" indexing table has a maximum non-accumulative tolerance of 0.001 inch between adjacent holes at a diameter of 30 inches. The number of indexing movements of the table can be varied to suit the operation by a simple interchange of one template with another. A manual or automatic adjustment permits varying the number of holes produced in a work-piece without disturbing the location of the part. Irregular series of holes can be drilled as easily as uniformly spaced holes. Normal or even excessive wear of the driving pinion and gear has no effect on the accuracy of the spacing between holes.

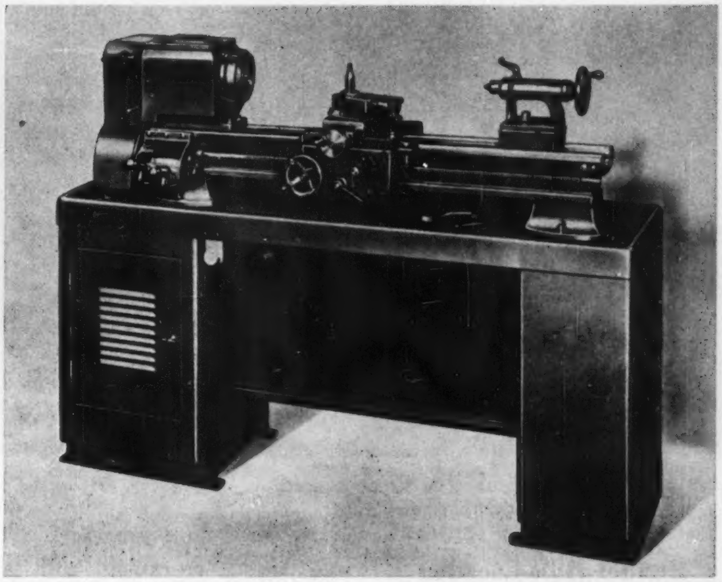
The table top may measure 30, 36, or 40 inches in diameter. Work-holding fixtures can be attached directly to this stress-relieved casting or to a steel sub-plate attached to the table top. The standard indexing range is from 2 to 100 stations. Irregular spacing is limited to a minimum of 3.6 degrees between stations.

Logan Lathe with Heavy Headstock

The Logan Engineering Co., Dept. M, Lawrence and Lamon Aves., Chicago 30, Ill., is now producing a 12-inch lathe with a heavy headstock, double V-belt outboard drive, ball-bearing mounted spindle, and a precision-built carriage. It has a 12-inch swing-over bed and saddle wings, 1-inch collet, 1 3/8-inch spindle hole, and center distances of 23 and 35 inches.

The lathe is designed to take heavy cuts, handle high-speed production runs, and hold work to tool-room tolerances. On heavy cuts its double V-belt drive, massive headstock, and extra heavy spindle combine to provide smooth power and rigidity. Sixteen spindle speeds, from 38 to 1260 R.P.M., are available.

The carriage has large dials designed for accurate readings, and a lever-operated disc type clutch. The top surfaces on the cross-slide and saddle are precision-ground to permit accurate mounting of fixtures and the use of magnetic indicators. The heavily ribbed bed is of balanced construction with two V-ways and two flat ways that are precision-ground to a tolerance of 0.0005 inch.

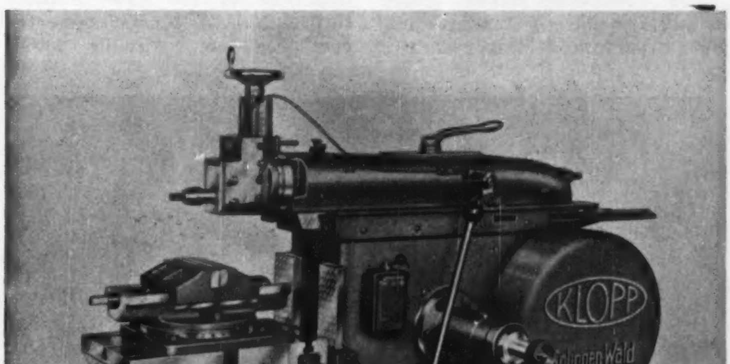


Lathe with heavy headstock announced by Logan Engineering Co.

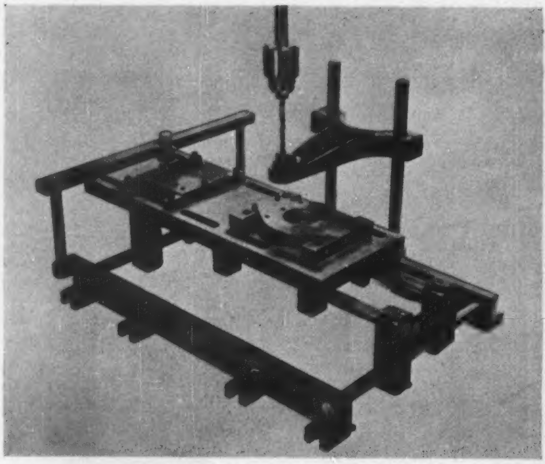
Shapers Equipped with "Controlled Contact" Type Drive

A major feature of the recently developed line of Klopp mechanical shapers now being distributed in this country by the Kurt Orban Co., Inc., Dept. M, 205 E. 42nd St., New York 17, N. Y., is the "controlled contact" drive. This drive is so designed that the pressure between the synthetic rubber wheel on the motor shaft and the drive wheel of the shaper is always proportionate to the load on the machine. A single lever controls the on-and-off positions of the motor switch, engages and disengages the drive, and sets and releases the brake that stops the tool-head. The motor is mounted on a tilting baseplate, and is started under no-load conditions, without the use of a mechanical clutch. In the running position, a spring presses a synthetic rubber wheel mounted on the motor shaft, against the cast-iron drive wheel of the shaper.

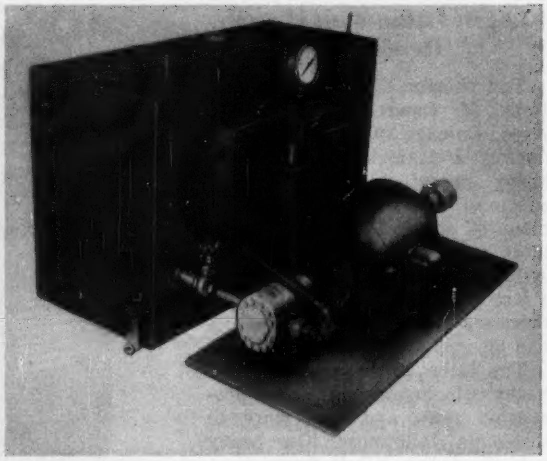
In starting the shaper, movement of the single control lever first actuates a switch to start the motor, with the drive disengaged. The brake-shoe, which is pressed against the drive wheel in the off position, is released, and gravity draws it away from the drive wheel. The friction wheel and drive wheel are then engaged. These shapers are available with stroke lengths of 16 3/4, 20 2/3, and 26 5/8 inches.



Klopp mechanical shaper of recently developed line introduced in this country by the Kurt Orban Co., Inc.



Precision hole-locating device announced by the Honnef Engineering Co.



Hydraulic power unit for presses made by the Clifton Hydraulic Press Co.

Honnef Hole-Locating Device for Drill Press

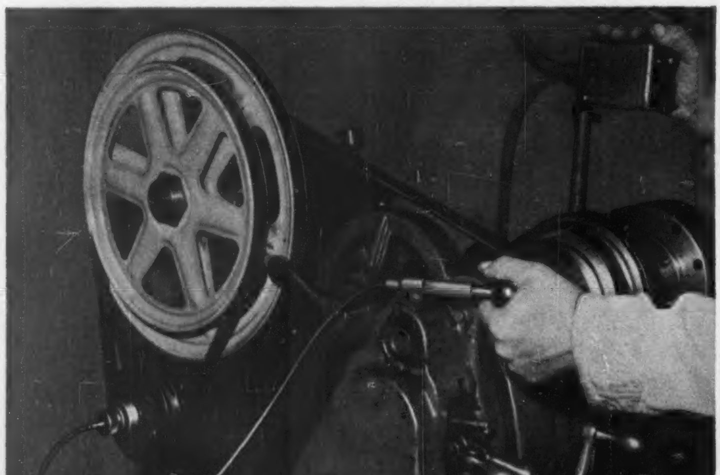
A hole-locating device called the "Production Master" has been brought out by the Honnef Engineering Co., Dept. M, Wethersfield, Conn. This device is said to eliminate much of the costly jig and fixture designing and building common in punch- and die-making and production drilling.

The "Production Master" is designed to enable any standard drill press to perform drilling, reaming, and boring operations with a high degree of accuracy. It will handle work up to 6 3/4 inches by 10 inches, and of any height permitted by the drill press on which it is used.

"Hydrau-Power-Pack" for Presses

The Clifton Hydraulic Press Co., Dept. M, 296 Allwood Road, Clifton, N. J., is producing a compact, high-low hydraulic power unit known as the "Hydrau-Power-Pack." This unit has a Unitrol feature which practically eliminates piping, screwed connections, and valves, and permits the repair or replacement of parts with a minimum of "down" time and maintenance costs.

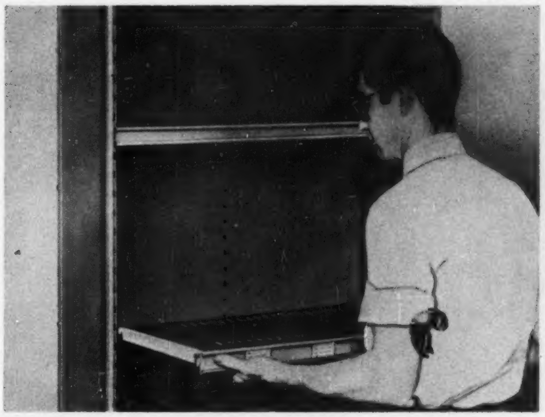
A solenoid-controlled operating valve for automatic presses is optional equipment on this unit. Capacities range from 5 to 50 gallons per minute on the low pressure side and from 1/2 gallon to 6 gallons per minute on the high pressure side. The maximum pressure is 10,000 pounds per square inch. A relief valve, check valve, reservoir filter, air breather filter, and large dial are furnished as regular standard equipment of the "Hydrau-Power-Pack" unit.



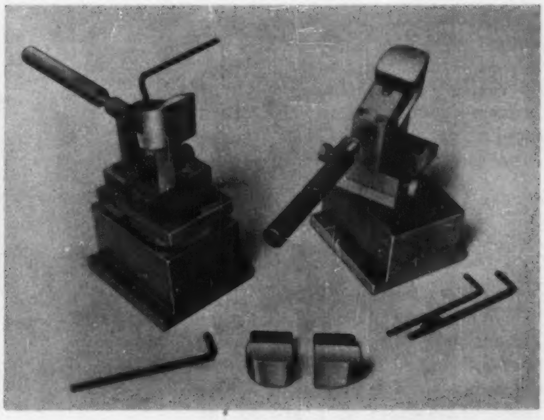
Lathe equipped with two-speed pulley drive from single-speed motor, made by Boulevard Machine Works

Two-Speed Driving Pulley for Small Single-Speed Motor

A two-speed pulley that can be used on a small single-speed motor to adapt it for two-speed motor applications is being manufactured by the Boulevard Machine Works, Dept. M, 2705 Empire Ave., Burbank, Calif. Operation of this pulley is simple. When the motor is running with the high-speed drive, a gentle pull on the control lever causes the drive to drop back into low speed. To change back to high speed, the driving torque is momentarily cut out by switching off the motor. At the same time, pressure is applied to the control lever to engage the high-speed drive. The motor switch is then reengaged.



Bin storage units with adjustable shelves made by the Berger Mfg. Division, Republic Steel Corporation



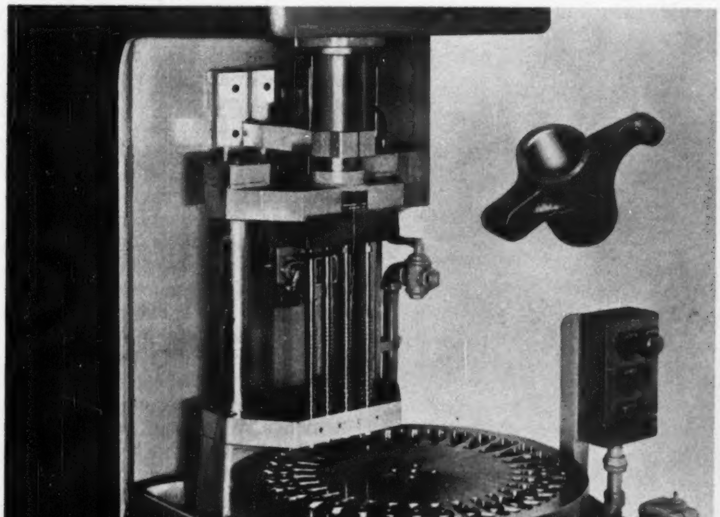
Radius grinding fixture for redressing tools used for finishing axles made by Apex Tool & Cutter Co., Inc.

Bin Storage Units with Adjustable Shelves

A new line of bin storage units with quick and easy shelf adjustment has been placed on the market by the Berger Mfg. Division, Republic Steel Corporation, Dept. M, Canton, Ohio. This line was developed to provide flexibility in storing automotive parts and all types of small equipment in industrial stock-rooms. The bins are 36 1/2 inches wide, 12 1/2 inches deep, and 84 inches high. They are made of heavy-gage steel. The easily adjustable shelves are spaced on 1-inch centers for vertical dividers and for any desired shelf spacing in increments of 1 1/2 inches.

Radius Grinding Fixture for Redressing Tools

A radius grinding fixture has been developed by The Apex Tool & Cutter Co., Inc., Dept. M, Shelton, Conn., for redressing radius tools of the serrated inserted type used for finishing axles and journal bearings with 1/8- to 3/4-inch radii. This fixture will regrind the 3/4-inch radius on both right-hand and left-hand tools. It has built-in adjustments to compensate for wear, both on the length and width of the tool. It has opposed roller bearings, and is designed to fit any table of a standard tool and cutter grinder, as well as most grinders with a mechanical infeed handwheel. Although designed primarily for 3/4-inch radius grinding, it can also be used to grind or dress other radii within a range of approximately 3/8 inch to 1 1/8 inches.



Colonial utility press equipped for rapid broaching and burnishing of rocker arms like the one shown in the upper right-hand corner of the illustration

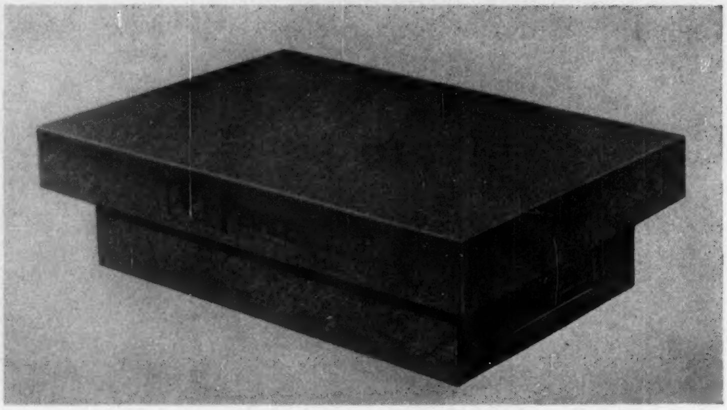
Colonial Press Equipped for Strip-Broaching and Burnishing Rocker Arms

Continuous strip-broaching and burnishing of automotive rocker arms at a production rate of about 1800 per hour can be accomplished with minimum operator fatigue on a 10-ton, 36-inch stroke utility press recently built and specially equipped by the Colonial Broach Co., Dept. M, Box 37, Harper Station, Detroit 13, Mich.

The equipment of this new machine includes an indexing-table fixture arranged for automatic ejection of the work. After being broached, the rocker arms drop through slots in the indexing table into a chute that delivers them to a container. Loading consists of dropping the parts into recesses in the table as it is indexed past the operator. The machine operates continuously, broaching four

rocker arms at a time. Approximately 0,010 inch of stock is removed from the work by this operation. Burnishers on the broaches reduce drag on the return stroke, permitting fast strip-broaching and long tool life.

Taft-Peirce Granite Surface Plates



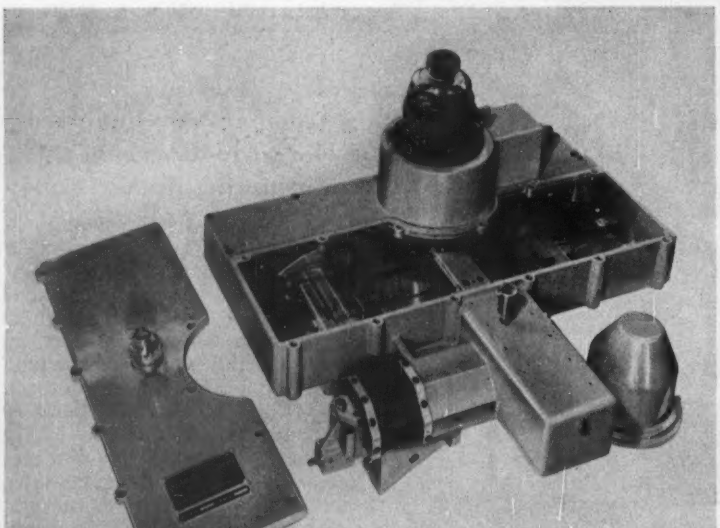
Granite surface plate brought out by the Taft-Peirce Mfg. Co.

The Taft-Peirce Mfg. Co., Dept. M, Woonsocket, R. I., has announced the addition of granite surface plates to its line of precision lay-out and inspection equipment. The angle of grain to the working surface is approximately 45 degrees, a characteristic which is claimed to minimize the possibility of chipping or plate breakage.

The working surface is extremely smooth, yet the natural pores of the granite prevent "wringing" of tools and assure free movement. This release in the air seal also eliminates the danger of erroneous measurements due to an air cushion under the instruments. The surface is non-abrasive, and because of the fine grain and low porosity it cannot become readily impregnated with dirt or grit particles to cause abrasion. Since the plate is non-magnetic, it is unnecessary to demagnetize work before checking. The working surface of the plates is easily cleaned with ordinary solvents.

Hoglund Automatic Contour Wheel Dresser for Cylindrical Grinders

The Hoglund Engineering & Mfg. Co., Inc., Dept. M, 343-1 Snyder Ave., Berkeley Heights, N. J., has brought out a Model 42 automatic contour wheel dresser that can be permanently mounted to the right of the footstock on an inclined-table type of plain cylindrical grinding machine. This dresser has been adapted to the Browne & Sharpe No. 5 plain grinder and also to the Norton 6- by 30-inch machine. It will also be available with different bases for other cylindrical grinders.



Hoglund automatic contour wheel dresser with cover removed to show the slide that carries the contour templates and the rack the variable-speed motor employs to drive it.

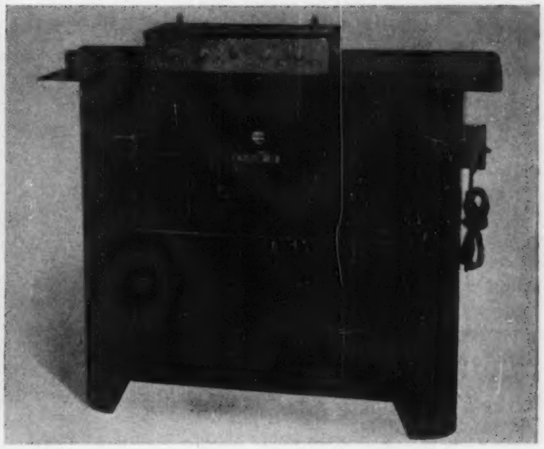
Almost any desired contour that can be followed by a dressing diamond can be formed in a grinding wheel with a high degree of accuracy. The diamond is traversed across the wheel in an uninterrupted movement, producing a true blend between the radii and tangents or any other complex form, an enlarged template controlling the movements of the dresser and the diamonds. A governor-controlled variable-speed motor operates the mechanism that controls the movement of the diamond. The motor drives a slide through a rack-and-pinion arrangement that carries the contour and feed templates.

The slides move on ball raceways that are hardened, ground, and lapped. A microscope fixture with a 40 to 1 magnification is used to facilitate precise setting of the diamonds in their holders. The width of wheel that can be contour-formed is variable up to 2 inches. Wheels of any diameter can be dressed. The weight of the dresser is 80 pounds.

Webber High-Low Temperature Bench Type Testing Chamber

A high-low temperature bench type testing chamber designed primarily for a branch of the Armed Services to cover extreme temperature ranges within a rela-

Webber unit for testing high and low temperatures



Lock rolling machine built by the Flagler Corporation

tively short time was recently announced by the Industrial Freezer Division, Webber Mfg. Co., Inc., Dept. 00260, 2740 Madison Ave., Indianapolis 3 Ind. The actual temperature range of the standard unit is from −80 degrees F., to +185 degrees F. Rapid lowering of temperature is a feature of this model, permitting a temperature pull-down to −80 degrees F. in thirty minutes or less.

The test chamber is 12 inches square, and the over-all outside dimensions are 50 inches long, 26 inches high, and 20 inches deep. The unit is compact, has simplified controls, operates quietly, and is equipped with air-cooled compressors. Application of heat is accomplished through the use of reverse cycle refrigeration, which eliminates the hazards associated with open heating elements. Optional equipment includes electrical terminals, shelves, automatic temperature cycling, and recording instruments.

Flagler High-Speed Lock Rolling Machines for Sheet-Metal Work

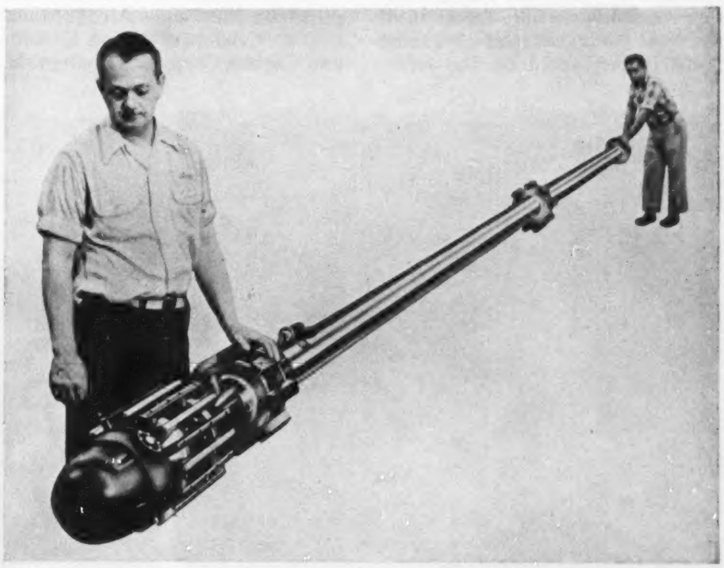
The Flagler Corporation, Dept. M, 19321 Filer Ave., Detroit 34, Mich., has announced two new high-speed lock rolling machines for use in making sheet-metal joints, one model handling 20-gage metal, and the other 22-gage metal. The machines are said to have a higher output capacity than preceding models. The Pittsburgh type lock for joining metal sheets can readily be formed on 20- or 22-gage stock at 50 feet per minute. Over 1000 drive cleats per hour can be produced with no special skill. Many other locks, flanges, and shapes can be formed in sheet metal with speed and uniformity.

Each machine has six pairs of powered forming rolls or roll dies, and there are no idler rolls. The gears are of casehardened steel. Closed-end roller bearings keep out dirt. The motor and the drive are enclosed in the base. Overload controls protect the motor.

Micromatic Tool Designed to Hone and Gage Atomic Gun Barrel

The Micromatic Hone Corporation, Dept. M, 8100 Schoolcraft, Detroit, Mich., has just released details of a tool 69 feet long which it designed and built to "Microhone" the bore of a 280-millimeter atomic gun barrel.

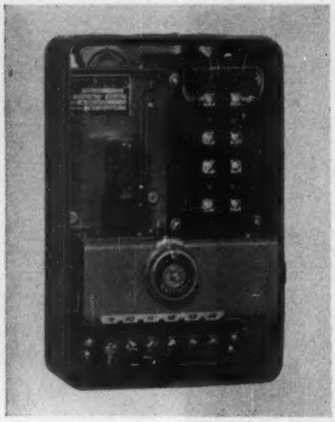
A gage in the nose of this tool makes it possible to check the diameter of the bore at any point throughout its full length, without removing the tool from the bore or the barrel from the machine. The use of this tool is said



Tool designed and built by Micromatic Hone Corporation for honing and gaging bore of atomic gun barrel

to reduce by 80 per cent the time that the barrel is kept at the Microhoning machine.

After the barrel has been honed to remove all inaccuracies resulting from previous operations, the diameter is checked within thirty seconds, by means of dials at a conveniently located control station. The 33-foot long barrel can be checked completely within a tolerance of 0.0003 inch in a few minutes. Previously, large gun barrels of this type required a full day for the checking operation. The distance from the muzzle end to the point being checked is also indicated on dials.



Electronic resistance-sensitive relay brought out by the General Electric Co.

G-E Electronic Relay

An electronic relay that is very sensitive to resistance changes and has a dial for stepless adjustment has been announced by the General Electric Co., Dept. M, Schenectady 5, N. Y. This relay can be used to start or stop a fractional horsepower motor directly when a contact-making ammeter, voltmeter, or wattmeter reaches a required meter reading. Other uses include liquid-level control, sorting of small parts, and operation of lights, solenoids, and contactors wherever there is a sufficient change in the resistance of an electrical circuit.

Two single-pole double-throw contacts permit control of independent systems, and a simple change sets the relay for normal or reversed operation. Selection of the most favorable relay operating point is facilitated by the sensitivity dial of the unit, which can be remotely controlled from as far away as 500 feet.

Power requirements are 115/230-volt alternating current, 50/60 cycles, and should not exceed 10-volt amperes. The relay enclosure is both weather-resistant and dust tight, making it suitable for both indoor and outdoor installations.

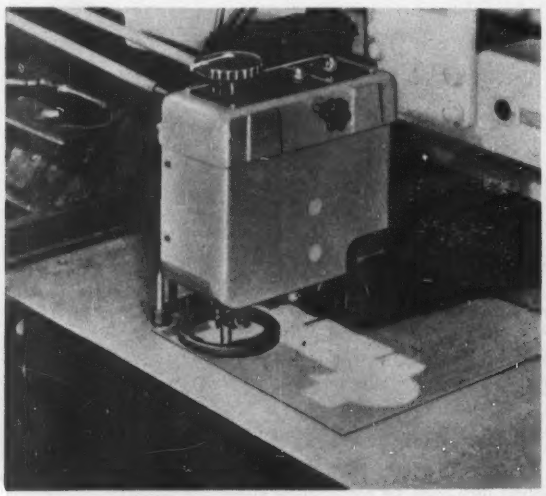
Oxweld Automatic Tracer Designed for Precise Shape-Cutting

A wide variety of metal shapes can be cut quickly and precisely with an automatic tracer introduced by the Linde Air Products Co., a Division of Union Carbide and Carbon Corporation, Dept. M, 30 E. 42nd St., New York 17, N. Y. When mounted on an oxy-acetylene shape-cutting machine, this tracer will reproduce the shape of any template, even when the design is intricate. Templates are easy to make, the desired shape being drawn to actual size on a plastic sheet and cut out. No allowance need be made for the kerf when preparing the template. Compensation for any kerf up to 1/4 inch in width is accomplished automatically by pre-setting the dial on the tracer.

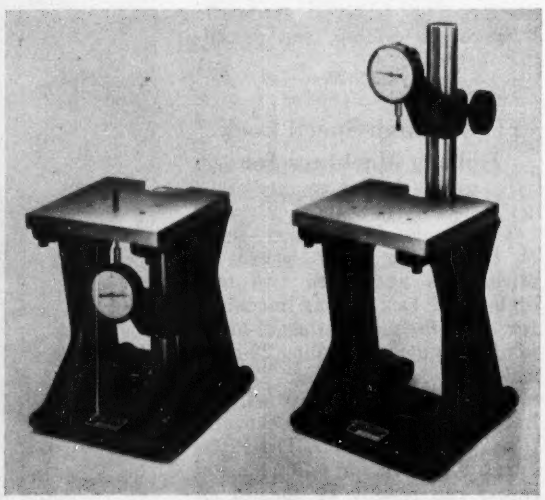
The tracing stylus always maintains positive contact with the template to assure cutting the metal to shape within close tolerances. The tracer can also be manually guided directly along the lines of a sketch or blueprint. The controls are simple and easy to operate. The raising and lowering handle, steering knob, and on-off switch can be operated locally or by remote control. Provision is made for stepless adjustment of the tracing speed within a range of 2 to 30 inches per minute. The tracing speed can be varied while the machine is operating.

Acra-Ment Bench Comparator

The Acra-Ment Gage Division, Meyer Corporation, Dept. M, 633 Park Ave., Cranston, R. I., has brought out a bench comparator for general-purpose gaging in machine shops, tool-rooms, and inspection departments. Height, thickness, depth, and offset measurements are facilitated by using the



Linde automatic tracer for oxy-acetylene shape cutting



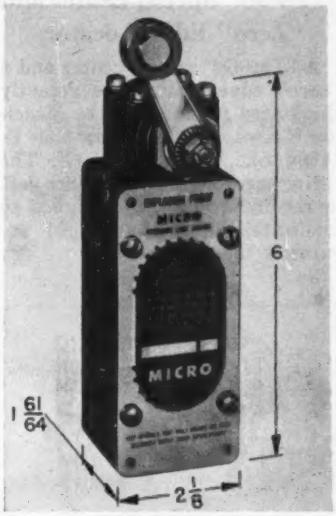
Acra-Ment comparator for shop and inspection department

indicator above and below the platen surface as shown by the two views in the illustration. The heavy platen with hardened steel gaging surface is secured to the Meehanite cast base. Tapped holes in the platen permit attaching gaging fixtures and positioning blocks made to fit the part being gaged.

Link-Belt Roller Chain Sprocket Wheels with Taper Lock Bushings

A line of roller chain sprocket wheels with taper lock bushings has been announced by the Link-Belt Co., Dept. M, 307 N. Michigan Ave., Chicago 1, Ill. Without reboring, these stock sizes of sprocket wheels can be securely mounted on a shaft with the equivalent of a shrink fit. Action of the taper lock bushing assures a tight fit within the full range of normal shafting tolerances. Set-screws force and hold the split bushing in the tapered bore of the sprocket wheel, causing it to lock tightly on the shaft. The full length of the bushing supports the sprocket on the shaft.

Assembly and disassembly of the shaft and sprocket can be easily accomplished. The turning of set-screws in removal holds serves to pull the bushing out of the tapered bore and cause it to release its hold on the shaft. Link-Belt sprocket wheels with taper lock bushings for 1/2-, 5/8-, 3/4-, 1-, and 1 1/4-inch pitch, single-width chains are now available.



Micro explosion-proof limit switch

Micro Explosion-Proof Limit Switch

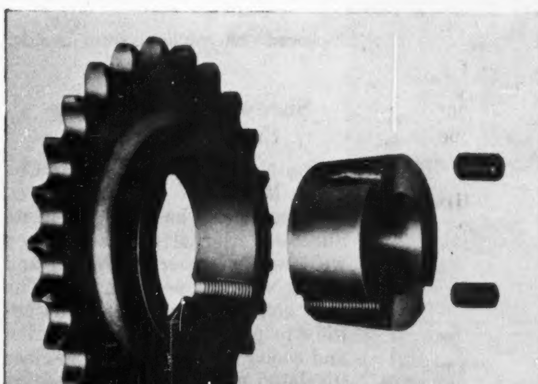
An explosion-proof heavy-duty precision limit switch, designed for use on all types of machinery and industrial equipment in explosive gas or vapor-air atmosphere, has been developed by the Micro Division of Minneapolis-Honeywell Regulator Co., Dept. M, Freeport, Ill. This switch, designated the IMLI-EI, is listed by the Underwriters' Laboratories as suitable for hazardous locations of Class I in Groups C and D. The operating head is adjustable to any of four horizontal positions and the roller arm assembly can be reversed to position the actuator roller on either side of the actuator arm. The roller arm is adjustable to operate clockwise, counter-clockwise, or in both directions. The actuator arm assembly is adjustable through 360 degrees to any of 870 positions at intervals of 0.4 degrees.

This explosion-proof snap-action switch is said to be the smallest available. Including the adjustable head, the switch case measures 6 inches high, 2 1/8 inches wide, and 1 61/64 inches deep. Underwriters' Laboratories list the switch for 20-ampere, 110, 220, or 440-volt alternating current; 1/2-ampere, 115-volt direct current; 1/4-ampere, 230-volt direct current; 3/4-H.P. 110-volt and 1 1/2-H.P. 220-volt alternating current.

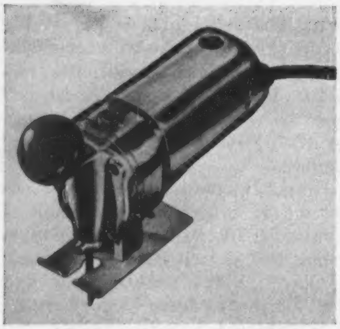
Wales Sheet-Metal Fabricator

A heavy-duty Model 10-C sheet-metal fabricator designed for punching, notching, and nibbling operations has just been made by the Wales-Strippit Corporation, Dept. M, 345 Payne Ave., North Tonawanda, N. Y. This fabricator has a throat depth of 27 inches with the back gage installed and of 30 1/2 inches with the back gage removed. The punch assembly holder arm swings to the right for changing punches.

The punches and dies are automatically aligned by the holder, which can be used in punching holes up to 3 1/2 inches in diameter. With each punch a set of dies is provided, made to meet the requirements for punching various types and thicknesses of metal stock.


Roller chain wheel with taper lock bushing announced by the Link-Belt Co.


Wales sheet-metal fabricator with large work-piece in position for punching



Versatile electric jig saw

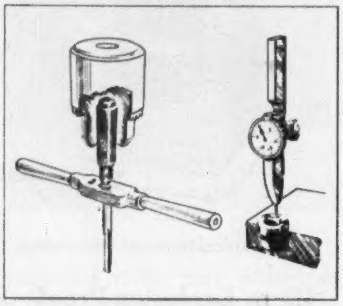
Black & Decker Electric Jig Saw

A portable electric jig saw designed to do the work of saber, keyhole, jig, and band saws has been announced by the Black & Decker Mfg. Co., Dept. M, Towson 4, Md. This jig saw can be easily held and guided with one hand. It is supplied with five different types of blades for cutting both hard and soft wood, plywood, ferrous and non-ferrous metals, rubber, leather, and plastics.

Besides its portable use, the saw can be mounted in an accessory table for bench work. A joint attachment for making strong, precision wood joints and a circle-cutting attachment for cutting circular pieces from 2 to 13 inches in diameter can be used with the table. Pocket cuts can be made in wood without drilling an entrance hole, and cuts can be made in places often inaccessible to circular or hand saws. It makes straight, curved, or irregular cuts with equal ease. The saw is powered by a Black & Decker universal motor for use on 115-volt alternating or direct current. It weighs 3 1/2 pounds, and has an over-all length of 8 inches and height of 7 11/16 inches. Equipment includes five different blades, toggle switch, and cable.

"Tap-Go" Spring Center and "Zero" Edge Locator

A "Tap-Go" spring center and a "Zero" edge locator are recently announced products of the Medelton Co., Inc., Dept. M, 335 E. 142nd St., Bronx 54, N. Y. The spring center, shown at the left in the illustration, is designed to facilitate the production of accurately tapped threads.



"Tap-Go" spring-loaded center and "Zero" edge locator

To obtain the best results with any tap, the tapping operation is performed at the same setting employed to drill the hole. After removing the drill and replacing it with the "Tap-Go" center and the tap, the spindle is fed down to compress the loading spring.

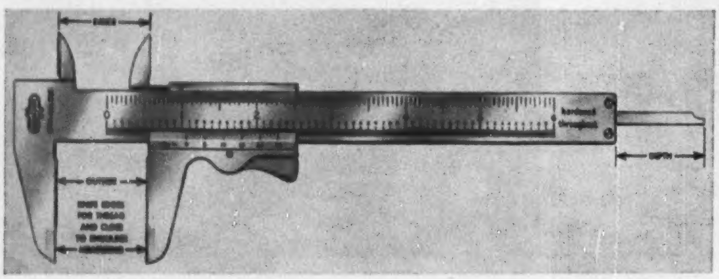
The "Zero" edge locator (at the right) is designed to enable the jig borer operator to locate the spindle directly over the work edge with an accuracy of 0.0001 inch. The indicator can be set to describe an accurate 0.5000-inch circle which, in turn, can be used to locate the spindle.

Mauser Vernier Caliper

The George Scherr Co., Inc. Dept. M, 200-R Lafayette St., New York 12, N. Y., has announced that the No. 64 universal Mauser vernier caliper for inside, outside, and depth measurements, previously furnished in chromium steel, will be superseded by the model No. 101, which will retain all important features but will be made entirely of stainless steel.

The new vernier with twenty-five lines covering forty-nine graduations of the scale is more than double the former size, thus permitting easier, more accurate reading of the scale. The slide has a hardened self-lubricating phosphor-bronze spring gib.

Two adjusting screws are provided for taking up any wear and to assure squareness of the measuring jaws. The measuring surfaces are accurately lapped. The caliper has three scales and verniers, the lower front scale reading to 0.001 inch, the upper front scale to 1/128 inch in fractions, and the back scale to 1/10 millimeter.



Stainless-steel Mauser vernier caliper introduced by the George Scherr Co.

Improved alternating-current welder

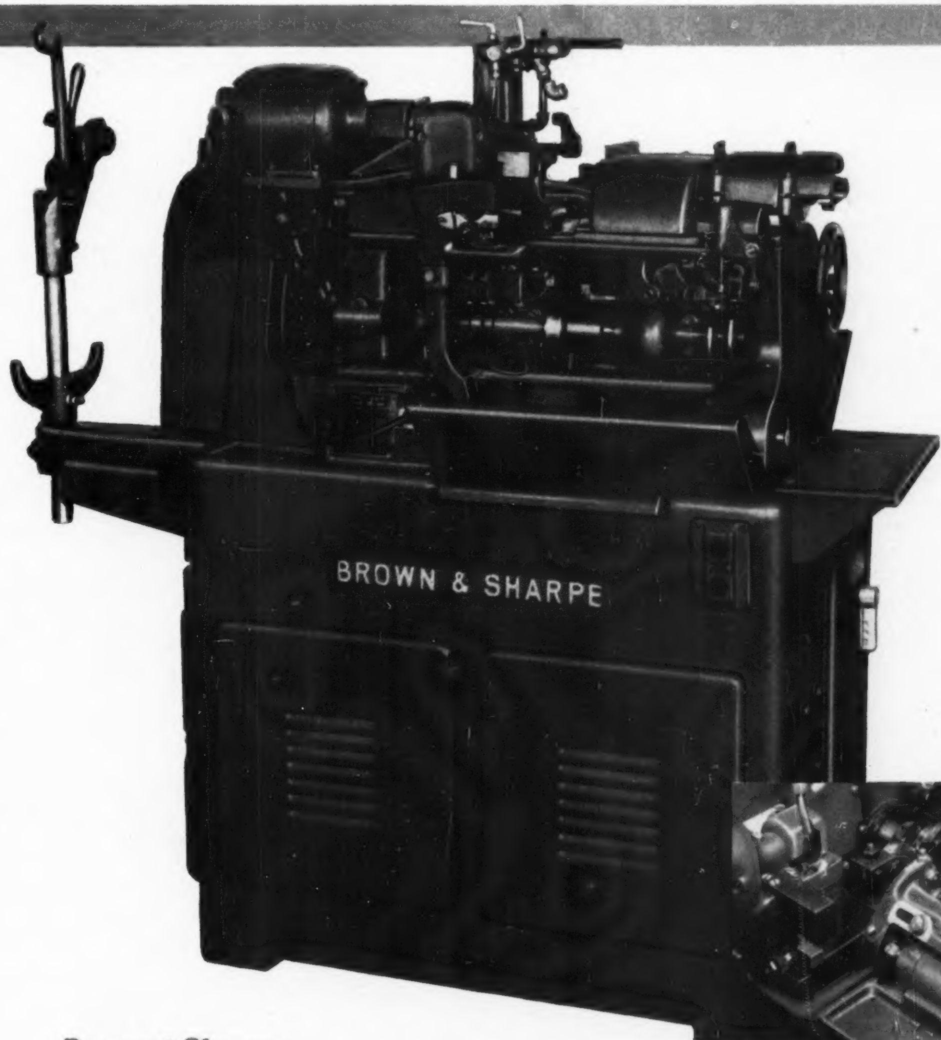
Sureweld Alternating-Current Welders

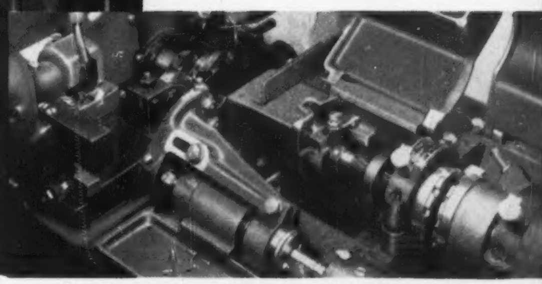
The National Cylinder Gas Co., Dept. M, 840 N. Michigan Ave., Chicago 11, Ill. has redesigned its Sureweld alternating-current shop welders for easier operation and better welding performance. The four coils are positioned horizontally to provide better ventilation and cooler operation. Double-glass insulated magnet wire is used for primary and secondary windings.

Two models are available—one with a welding range of 25-295 amperes, with and without power factor correction; the other with a range of 20-180 amperes.

Screw Threading "Professional"...

...does **4** operations at once, makes screws, pins, bushings at unbelievably high speed





After forming, threading and partial cutting-off on tandem pieces, Transfer Arm swings into position to move finish-turned piece from work spindle to slotting mechanism.

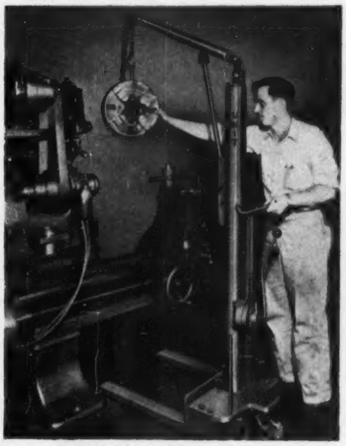
Brown & Sharpe

Automatic Screw Threading Machine

This machine minimizes idle time by overlapping such operations as forming, threading, slotting and partial cutting-off. Two opposed spindles (the work and threading spindles) rotate in the same direction but at different speeds . . . permit threading and partial cutting-off on one piece while forming is performed on a succeeding piece. At the same time, a third piece is slotted in the automatic slotting mechanism. Thus, unusually high production of a wide variety of small screws, pins, bushings, etc., is possible at lowest cost. Takes stock to 3/8" dia. Many other features combine to make this machine a highly profitable investment for any screw machine department. Write for full details.

Hydraulic Shop Truck with Boom, Forks, and Platform

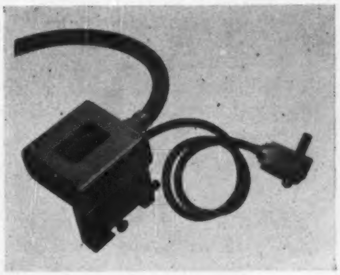
Hydraulically operated shop truck designed to handle all lifting jobs within its capacity whether they require a boom, forks, or a platform. The boom has a lifting height of 8 feet; the forks will lift a pallet to 55 inches and need a clearance of only 3 1/4 inches. A platform is locked over the forks for lifting loads without pallets. A load of 750 pounds can be raised by the one-hand operation of a 5000-pound hydraulic system. The base is 22 1/2 by 33 inches, and has a foot-operated



locking brake. Available from the Unit Mfg. Co., Dept. 147, 1229 Harmon Place, Minneapolis, Minn.

Wheel Dresser with Automatically Indexed Truing Diamond

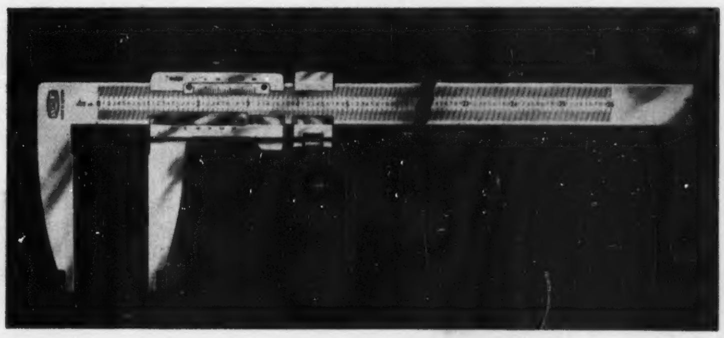
Grinding wheel dresser with compact self-contained electromechanical device designed to automatically index the dressing

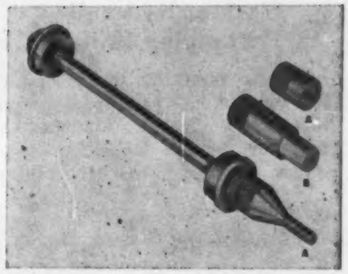


diamond by precise increments. This action continually presents a new sharp diamond edge for each wheel dressing. The device will rigidly support a standard shank diamond tool. It provides indexing ranges to meet all grinding wheel truing requirements by utilizing odd increments of rotation so that the pattern of flats worn on the diamond will never repeat. The dresser is operated by 115-volt current, or it can be operated manually. Developed by the Industrial Diamond Co., Dept. M, 2392 Wolcott, Ferndale 20, Mich., in cooperation with the Corr Instrument Co., this diamond dresser has been thoroughly field tested in several of the large automotive shops.

Precision Vernier Caliper

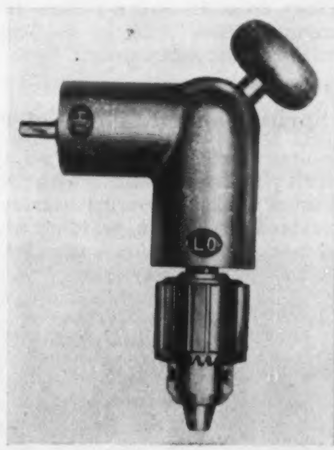
Vernier caliper of improved line distributed by Homestrand, Inc., Dept. M, Larchmont, N. Y. The calipers in this line have been redesigned for easier handling and a higher degree of accuracy. They have fitted adjustable vernier plates, both inside and outside measuring scales on the face of the tool, and double-spaced vernier graduations. All measurements can be read directly without turning the calipers around. Available in 12-, 24-, and 36-inch sizes.





Wade Stop for Draw-In Type Collets

Stop for draw-in type collets designed to facilitate handling certain kinds of second-operation work, including the production of parts in which shoulder lengths must be duplicated within very close limits. Adjustments can be made without removing the stop from the collet or the collet from the lathe. Practically the full length of the collet can be utilized for the work-piece. Provided with the stop are two solid pads *A* for different diameters of work and one spring pad *B* for ejecting work as soon as the collet is released. Placed on the market by the Wade Tool Co., Dept. M, Waltham, Mass.

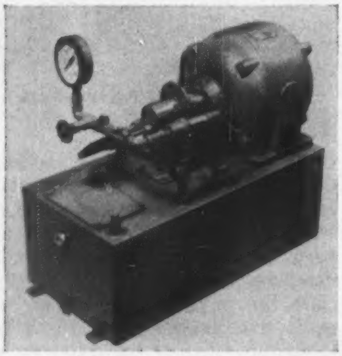


"Korner King" Right-Angle Drill Attachment

"Korner King" right-angle attachment for heavy-duty 1/4-inch electric drills. This compact drive makes available two additional speeds. For example, electric drills having a speed of 2000 R.P.M. can be used to drive drills at a speed of 1000 R.P.M., or the drive can be reversed to give a higher speed. Product of the R.C.S. Tool Sales Corporation, Dept. M, Joliet, Ill.

Hackett Hydraulic Pumping Unit

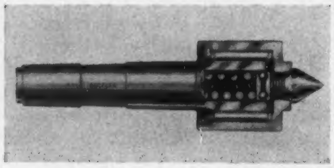
Hydraulic pumping unit brought out by Hackett Brothers, Inc., Dept. 136, North Manchester, Ind., for use on lathes, presses, brakes, conveyors, machine tables,



and other mechanical equipment. The all-steel reservoir is of welded construction and the Nitralloy gear pump has a high-strength aluminum-alloy case. The unit is completely piped with relief valve, check valve, reservoir filter, and air breather filter. Pressures range up to 1200 pounds per square inch and capacities from 0.8 to 2.8 gallons per minute. This unit is available with or without motor.

Spring-Loaded Live Center

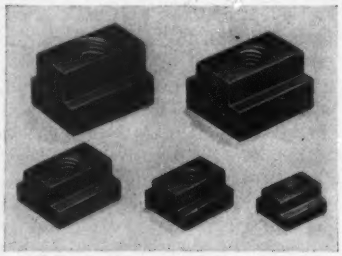
Bulfex Model FHH heavy-duty spring-loaded live-center with preloaded precision journal bearings adapted for use on grinding machines, lathes, milling machines, turret lathes, gear cutters, and



innumerable other applications. The high-speed steel point is ground under loading in its own bearings to maintain a concentricity accuracy of 0.0003-inch total indicator reading. Announced by Bultool Co., Dept. M, Box 5094, Southfield Station, Detroit 35, Mich.

T-Nuts in Wide Range of Sizes

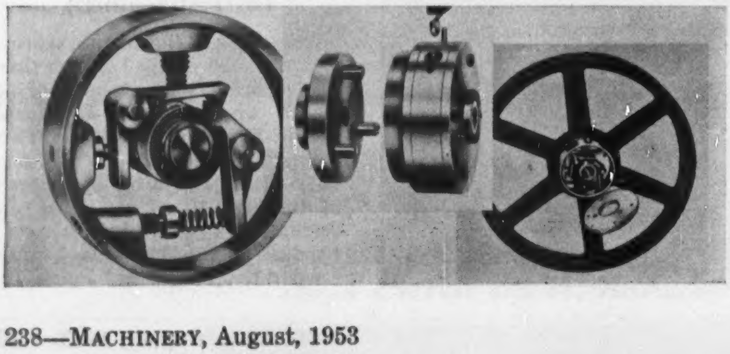
T-nuts in a line that includes fifteen sizes made by mass production methods to suit a wide range of machine tool applications.

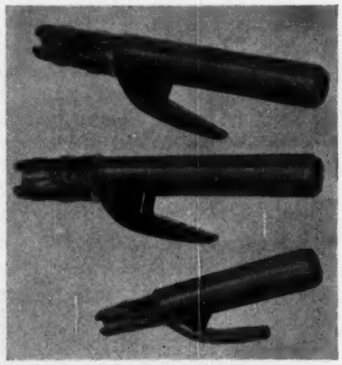


These nuts have been brought out by the Jergens Tool Specialty Co., Dept. M, 712 E. 163rd St., Cleveland, Ohio, to eliminate the need for making nuts of this kind by expensive small-lot tool-room methods. The line now includes T-nuts in throat sizes ranging from 7/16 inch to 1 1/8 inches to fit the slots in tables and automatic cross-slides of milling machines, automatics, turret lathes, brakes, punch presses, shears and planers. All sizes are accurately machined from heat-treated alloy steel having a tensile strength of 200,000 pounds per square inch.

Overload Release Clutch

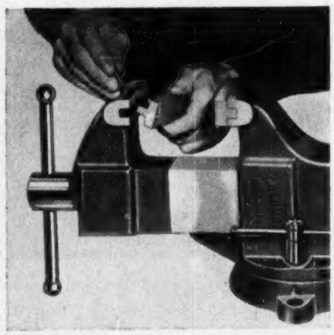
Clutch designed to release instantly when an overload is applied. It can be easily installed on sprocket, chain, belt, and gear drives, and allows operation to be resumed at the exact cycle point at which the instantaneous trigger release action occurred. Available in a wide range of speeds and shaft sizes from Overload Release Clutch Co., Inc., Dept. E, 1162 Stuyvesant Ave., Irvington, N. J.





Lightweight Electrode-Holder

Lightweight electrode-holder for arc welding made available by the Welding Products Division, A. O. Smith Corp., Dept. M, Box 584, Milwaukee, Wis. Since the jaw-opening lever is located close to the handle, any tendency of the holder to roll in the hand is eliminated. The electrode stub is released by simply squeezing the lever to handle. Available in 200-, 300-, and 500-ampere sizes.

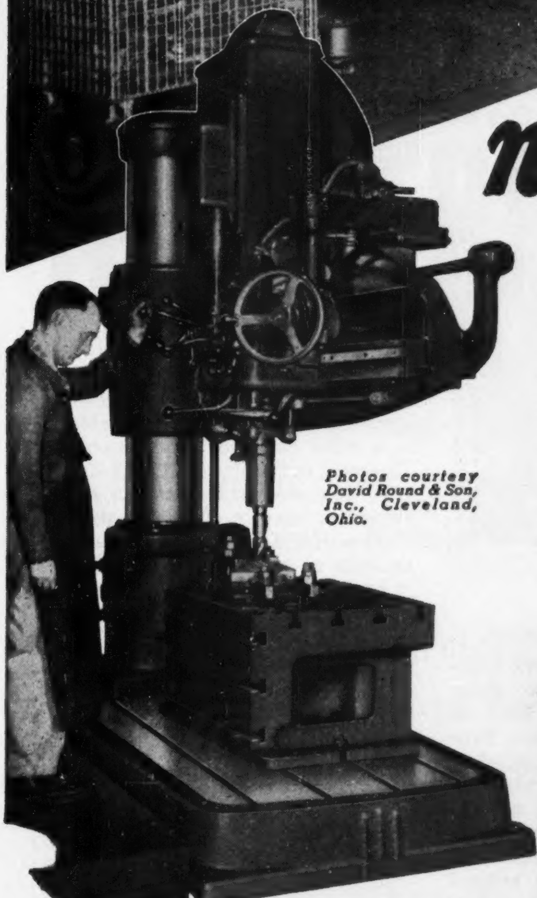


Special Faces for Vise Jaws

Special jaw faces can be provided on standard machinists' vises marketed by the Columbian Vise & Mfg. Co., Dept. M, 9021 Bessemer Ave., Cleveland 4, Ohio. The line includes smooth jaw faces of hardened steel to protect soft materials and finished surfaces, and copper non-sparking, non-magnetic faces. Special faces, designed to fit irregularly shaped pieces, are also available.

before, ~~20~~ minutes...

now, 6 minutes



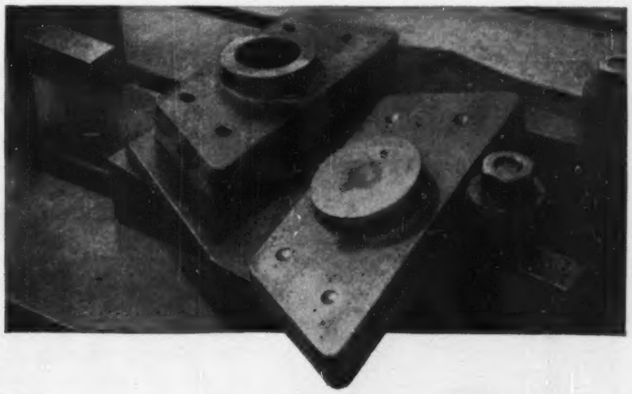
Photos courtesy David Round & Son, Inc., Cleveland, Ohio.

The outstanding performance of this Cincinnati Bickford Super Service Radial Drill brought approximately 50% cost savings at David Round & Son, Inc., manufacturers of cranes, hoists, winches and trolleys.

For example on the 4 ton steel trolley sides the time on drilling and reaming fell from 20 minutes to 6 minutes.

The right Cincinnati Bickford Super Service Radial Drill may effect parallel savings in your shop—Investigate.

Write for Catalog R-29.



CINCINNATI BICKFORD

SUPER SERVICE CB RADIAL AND UPRIGHT DRILLING MACHINES

THE CINCINNATI BICKFORD TOOL CO.

Cincinnati 9, Ohio, U.S.A.

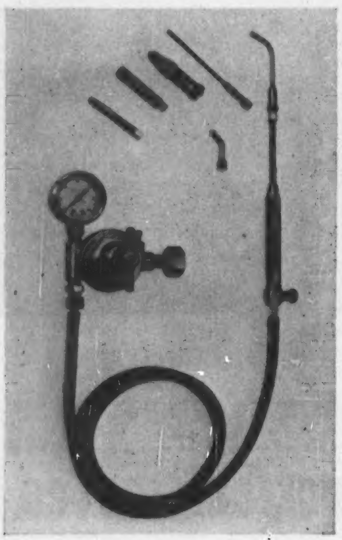
Sawing Attachment

Cam-actuated sawing attachment developed by the E-Z Way Tool Co., Dept. M, Barrington, Ill., to convert the rotary power of an electric drill into a reciprocating

motion for sawing operations. This attachment can be applied directly to any heavy-duty electric drill and used for fast cutting of metals and other materials. Specially designed blades make starting holes unnecessary. Any make of hacksaw or key-hole blade can be used. The weight is 3 1/2 pounds.

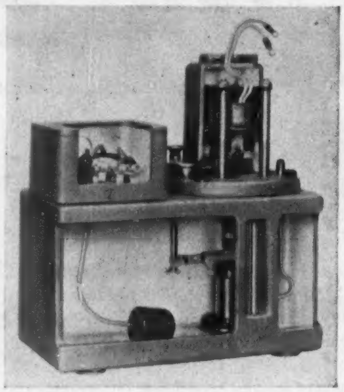
Torit Acetylene Torch Equipment

Acetylene torch welding equipment designed to perform practically any light heating, brazing, or soldering operation, recently placed on the market by the Torit Mfg. Co., 307 Walnut St., St. Paul 2, Minn. This unit uses only an acetylene gas tank, yet develops a temperature of 2800 degrees F. Four tips, an adapter unit, and a soldering copper are supplied.



Teflon Back-Up Rings for O-Ring Seals

Back-up rings, spirally machined from tetrafluorethylene (Du Pont's Teflon) have been designed by the Garlock Packing Co., Dept. 34, Palmyra, N. Y., to prevent extrusion of O-rings. The Teflon rings have a high impact strength at temperatures from—100 degrees F. to 500 degrees F. They are non-corrosive, non-adhering, non-fraying, inert to most chemicals, and self-lubricating. They are made for all O-ring sizes.

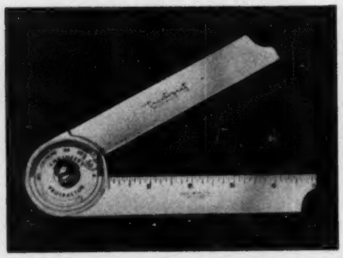


Automatic Lubricator

Solenoid-operated automatic lubricator developed by the Bijur Lubricating Corporation, Dept. M, Rochelle Park, N. J. This Type "E" lubricator can be applied to almost every type of machine and mounted in any location, no connection to a moving element of the machine being required. It can be actuated by switches tripped by rotary or reciprocating motion, existing control circuits, electric timer controls, or push-buttons. The unit is therefore adaptable to use on special machinery as well as standard models.

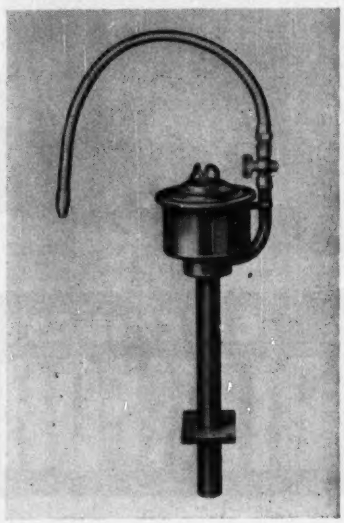
Adjustable Protractor

Adjustable protractor designed to serve as a miniature drafting machine, placed on the market by the Way-Mac Mfg. Co., Dept. M, 8112 Melrose Ave., Los Angeles 46, Calif. This "tractograf" is intended for use by engineers, draftsmen, architects, and students. Any angle from 0 to 180 degrees can be drawn instantly without turning, sliding, or moving the protractor out of position by swinging the upper rule arm to the desired angle and locking the adjustment knob. A built-in magnifier, gives hairline adjustment. Mathematical formulas are printed on the reverse side of the calibrated dial. A 5-inch rule on the lower arm is provided as an added convenience.



Viking Motor-Driven Coolant Pump

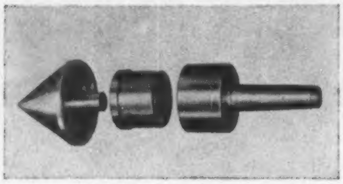
Self-contained motor-driven coolant pump that is quickly adaptable to a wide range of applications. This unit is equipped with a 1/30-H.P. oil-sealed motor, and is designed to operate efficiently with all types of water-soluble coolants and oils up to 20 S A E viscosity. It has a rated capacity of 100 gallons per minute at a 1-foot head.



The inlet pipe has a 1/2-inch opening and is equipped with an automatic foot valve to hold the priming. The flexible spout outlet is 1/4 inch in diameter. The unit weighs 3 pounds, has a diameter of 4 1/2 inches, and is 15 inches high. Product of Viking Industries, Dept. M, 220 Montague St., Rockford, Ill.

Jergens Live Center for Heavy Thrust Loads

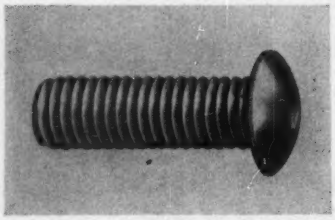
Live center with No. 4 Morse taper shank announced by the J. G. Jergens Co., Dept. M, 11106 Avon



Ave., Cleveland 5, Ohio. This center is designed to withstand heavy thrust loads in taking cuts with carbide tools, and it is also especially adaptable for use on lathes employed for metal-spinning operations.

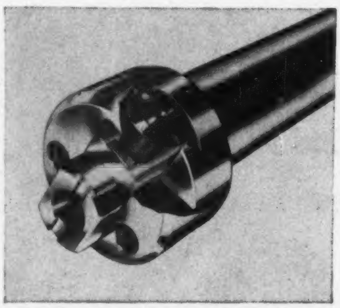
"Minute Man" Combination Keyway Broach Kit

Keyway broach kit assembled to cover a wide range of hole sizes in 1/16-inch increments. This combination "Minute Man" No. 1-1A combination kit provides broaches and bushings for standard width keyways in eighteen bore diameters conforming to American key standards. By interchanging broaches and bushings, thirty-six different combinations of keyways can be cut. Product of the du Mont Corporation, Dept. M, Greenfield, Mass.



Allen Button-Head Cap-Screw for Streamlined Surfaces

Button-head cap-screw brought out by the Allen Mfg. Co., Dept. M, Hartford, Conn., for use where smooth, streamlined surfaces are desirable, especially in applications that do not permit countersinking. The rounded top and flush edge of this cap-screw has no exposed sides. Cold-working and drawing impart extra strength to the special Allenoy steel of this button-head cap-screw that compensate for its necessarily thinner head. Sizes available range from No. 8 by 1/4 inch through 5/8 inch by 2 inches, with NC threads. Except for the 1/2- and 5/8-inch sizes, the screw is also made with NF threads.

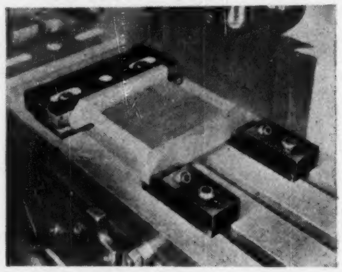


Heavy-Duty Offset Boring Chuck with Quick-Change Feature

Samson heavy-duty offset boring chuck announced by the Last Word Sales Co., Dept. M, 18500 Mt. Elliot, Detroit 34, Mich. This chuck has a positive dead-centering feature which permits the interchangeable use of drills, end mills, fly tools, and similar cutters without the necessity of removing the chuck from the machine. Tool changes can be quickly made. There is an extra large dial with micrometer screw for adjustment of offset and accurate resetting of the tool to facilitate handling in duplicate work.

J & S Vise Jaws for Machine Tools

Hinged, spring-loaded vise jaws designed to give positive downward clamping action on work mounted on table of jig borer, miller, planer, or shaper, marketed by the J & S Tool Co., Inc., Dept. M, 644 W. Mt. Pleasant Ave., Livingston, N. J. Hinged "in-and-



down" action of jaw combined with similar action of clamp holds work-piece against table with force of 1/2 ton to 3 tons. The vise parts are made of oil-hardened tool steel and are ground and given a blackened finish.

Crown Right-Angle Drive

Compact miter gear-box drive with shafts for transmitting power or motion at right angles. Made in 1/3- and 1-H.P., 1800-R.P.M. sizes. Each size has both a two-way and a three-way shaft extension with a choice of five mounting faces. The 1/3-H.P. unit has a static torque of 250 inch-pounds, while the static torque of the 1-H.P. unit is 750 inch-pounds. Manufactured by Crown Gear, Inc., Dept. M, 290 West St., Keene, N. H.

For the long haul... Autocar relies on RB&W bolts

Famous truck builder rates them best for ease of assembly and accessibility

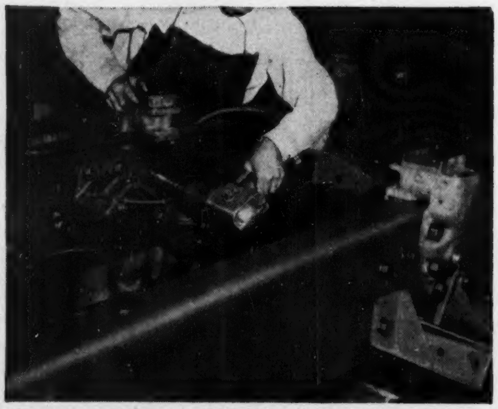
It's been a long time since the Autocar people switched from riveted to bolt-and-nut construction. Here's how it happened:

Two Autocar engineers took off on a coast-to-coast run to shake the bugs out of a new test model. Things went well until a riveted spring bracket broke. It took an entire day just to chisel through the rivets because it was hard to get at the bracket.

From that day on, it was *accessible* bolt-and-nut construction exclusively for all Autocar trucks. And Autocar standardized on RB&W bolts. One dividend from using these rugged bolts is that Autocar can specify higher-strength material than is practical for riveting. Furthermore, tests on structures like bridges show that rivets frequently loosen. This doesn't happen to bolts on Autocar frames.

Where you want to join structural members firmly together so they'll *stay* together for good, high-strength bolting is often your best bet.

As the leading manufacturer of all kinds of fasteners, we're in the unusual position of always being able to recommend and supply the right ones for all your needs. Write to RUSSELL, BURDSALL & WARD BOLT AND NUT COMPANY, Port Chester, N. Y.



FASTER FASTENING is achieved in the Autocar plant at Ardmore, Pa., by using air tools like the one shown here to run up RB&W nuts on RB&W bolts on an Autocar truck frame. In addition to making tight, accessible joints, bolting effects substantial assembly savings.

3.1

RB&W

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Plants at: PORT CHESTER, N. Y., CORAOPOLIS, PA., ROCK FALLS, ILL., LOS ANGELES, CALIF. *Additional sales offices at:* PHILADELPHIA, PITTSBURGH, DETROIT, CHICAGO, DALLAS, SAN FRANCISCO. *Sales agents at:* PORTLAND, SEATTLE. *Distributors from coast to coast.*

PRODUCT INFORMATION SERVICE

Use the postage-free postcard below for further information on New Catalogues described in the August, 1953, issue of MACHINERY. Circle Key number of item in which you are interested and print name and address on postcard.

NEW CATALOGUES

METAL STAMPINGS—Dayton Rogers Mfg. Co., Minneapolis 7, Minn. Manual explaining the technique of precision piercing and blanking of die-cut stampings in small lots. Suggested basic designs for metal stampings are given. Can be obtained when requested on a company letterhead direct to the above address.

JET-ENGINE MACHINES—Ex-Cell-O Corporation, Detroit, Mich. Bulletin 50731, describing in detail five Ex-Cell-O machines and the sequence of operations used for the machining of jet rotor blades and buckets from rough forgings to highly finished products. Two new vertical machines used for machining compressor rotor discs, engine frames, and other large round parts are also shown. 1

CORROSION RESISTANCE OF COPPER AND COPPER ALLOYS—The American Brass Co., Waterbury, Conn. Booklet B-36R, containing the results of a study by the company on the corrosion resistance of copper and copper alloys, explaining the chemical and physical nature of corrosive attack in its various forms. Corrosion rating charts give relative ratings for copper and commonly used copper alloys. 2

FLEXIBLE METAL TUBING—Titeflex, Inc., Newark, N. J. Catalogue 200, containing 48 pages of information on Titeflex helically wound flexible metal hose and Uniflex helically corrugated flexible metal hose. An engineering data section furnishes charts on frictional losses versus flow rates in flexible hose, and also describes installation and maintenance of metal hose. 3

ALUMINUM FABRICATING SERVICE—Reynolds Metals Co., Louisville, Ky. Booklet listing in considerable detail the fabricated parts and sub-assemblies available from the company, and showing its facilities for blanking, forming, welding, brazing, assembling, and finishing operations. Typical parts being produced by the Reynolds Parts Division are shown. .. 4

PROFILE MILLING MACHINE—Onsrud Machine Works, Inc., Chicago, Ill. Bulletin 1140, providing complete information on the design, construction, and machine movement of the Onsrud Model A-72 InvOmil profile milling machine with skin milling attachment for the irregular profile milling of inside and outside contours at high speeds and feeds. 5

CEMENTED CHROMIUM-CARBIDE—Carboloy Department of General Electric Co., Detroit, Mich. Technical report CC-100 on Series 600 Carboloy Chrome Carbide Grade 608, a powdered metal product that is highly resistant to corrosion and erosion. Methods of attachment and finishing techniques are included, as well as a discussion of physical properties. 6

FURNACE AND OVEN CONTROL INSTRUMENTS—Bristol Co., Waterbury, Conn. Bulletin P1255, entitled "Bristol Control Instruments for Furnaces, Ovens, Dryers, and Kilns," in which a wide variety of electric, air-operated, and electronic control instruments for use with fuel-fired and electric heating equipment of all types is described. 7

CYLINDRICAL GRINDING MACHINE—Van Norman Co., Springfield, Mass. Bulletin describing the 418 plain cylindrical grinding machine designed to provide economical production grinding of small parts in tool-rooms and job shops or plants where work is usually in small or medium runs. 8

SHEAR KNIVES AND SLITTER KNIVES—American Shear Knife Co., Homestead, Pa. 72-page handbook intended as a guide for the selection of grades of shear knives and slitter knives, with suggestions on their care and proper operation. Shear and slitter knife tolerances are given, as well as hints for grinding of used shear knives and helpful tables. 9

LUBRICATION—Farval Corporation, Cleveland, Ohio. Bulletin 26, describing Farval centralized systems of lubrication, which provide a positive mechanical method of dispensing oil or grease under pressure to a group of bearings from one central station, in the desired quantities. 10

HARD-FACING—Cleveland Hard Facing, Inc., Cleveland, Ohio. Booklet describing a method of applying hard alloy metal to a low-alloy steel base at areas of wear, thus holding down production costs on original equipment and increasing the operating life of worn equipment. 11

MINIATURE SELENIUM RECTIFIERS—General Electric Co., Schenectady, N. Y. Bulletin GEA 5935, containing data on the construction features and electrical characteristics of G-E small selenium rectifier stacks for electronic circuit applications. 12

LOCATING FLAWS BY THE DY-CHEK METHOD—Turco Products, Inc., Los Angeles, Calif. Booklet A-500, outlining many applications of Turco Dy-Chek, a portable inspection method, together with an explanation of the Turco Chek-Spek method for high-volume inspections. 13

CARBIDE TOOLS—Charles L. Jarvis Co., Middletown, Conn. Bulletin giving detailed information on Jarvis tungsten-carbide and high-speed steel rotary files; and carbide end-mills, reamers, internal grinding tools, drills, boring bits, and boring tools. 14

TAPS—Wood & Spencer Co., Cleveland, Ohio. Catalogue 7, containing 130 pages of detailed information on the company's line of taps, a directory of tap tables to help in choosing the right tap at the right time, and a section entitled "Tapping Tips." 15

CASTINGS—Wellman Bronze & Aluminum Co., Cleveland, Ohio. Catalogue 53, descriptive of the company's production facilities for a wide range of aluminum, magnesium, and bronze-alloy castings in sand, semi-permanent, and permanent mold form. 16

GROOVING TOOL—Waldes Kohinoor, Inc., Long Island City, N. Y. Catalogue gt 2-53, covering the Waldes Truarc grooving tool for the precision cutting of recesses in housings and bores. Typical applications are illustrated diagrammatically. 17

SOCKET SCREW PRODUCTS—Standard Pressed Steel Co., Jenkintown, Pa. Folder 867, on Unbrako socket screw products, such as socket-head cap-screws, self-locking set-screws, shoulder screws, flat-head socket cap-screws, and button-head socket screws. 18

RESEARCH AND DEVELOPMENT SERVICES—Designers for Industry, Inc., Cleveland, Ohio. Folder outlining the company's facilities for developing engineering projects in the mechanical, hydraulic, electro-mechanical, and electronic fields. 19

LUBRICATORS—Bijur Lubricating Corporation, Rochelle Park, N. J. Bulletin NB-11, on the company's Type E solenoid-operated lubricators, adaptable to many types of machines, showing, in particular, three applications. 20

INERT-GAS METAL-ARC WELDING—Air Reduction Sales Co., New York City. Reprint entitled "Will Inert-Gas Metal-Arc Save Money on Mild Steel?"—reporting the results of weld tests on mild steel with the inert-gas metal-arc welding method. 21

CAM AUTOMATICS—Motch & Merryweather Machinery Co., Cleveland, Ohio. Bulletin 4000, descriptive of three models of cam automatics—one for valve tappets and another for electric motor rotors, and the third for shell production. 22

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TOGGLE SWITCHES—Micro, a Division of Minneapolis-Honeywell Regulator Co., Freeport, Ill. Catalogue 73, explaining diagrammatically features of Micro toggle switches and toggle switch assemblies, and giving characteristics and electrical ratings. 23

CUTTING-OFF WHEELS—Grinding Wheel Institute, Cleveland, Ohio. Booklet entitled "Cutting-Off Wheels," covering usage, classification, speeds, and mountings, as well as other subjects such as technique and handling of the work. 24

SHOT-PEENING APPLICATIONS—Metal Improvement Co., Los Angeles, Calif. Booklet explaining what shot-peening is and what it can do, and showing applications in the company's shop. A bibliography on shot-peening has been included. 25

LATHE ATTACHMENTS—Nebel Machine Tool Co., Cincinnati, Ohio. Folder describing the company's complete line of attachments and accessories for use on Nebel heavy-duty engine, removable block gap and extension bed gap lathes. 26

CEMENTED-CARBIDE TOOLS AND BLANKS—Carboloy Department of General Electric Co., Detroit, Mich. Catalogue GT-265, entitled "Brief-A-Log," consisting of a condensed price list and specifications of the company's standard cemented-carbide tools and blanks. 27

WASHERS AND METAL STAMPINGS—Quadriga Mfg. Co., Chicago, Ill. Booklet descriptive of the company's line of washers and metal stampings. A table of standard gages is presented, as well as other useful information. 28

ARC-WELD SURFACING—Lincoln Electric Co., Cleveland, Ohio. Bulletin 466, a "Weldirectory" containing specific information on Lincoln hard-surfacing, such as a chart comparing types of hard-surfacing material and a guide for the selection of Lincoln electrodes. 29

HORIZONTAL HYDRAULIC BROACHING MACHINES—American Broach & Machine Co., Ann Arbor, Mich. Circular 502, describing a new line of horizontal hydraulic broaching machines ranging in size from 15- to 60-ton capacity manufactured by the company. 30

ARC-WELDING STAINLESS STEELS—General Electric Co., Schenectady, N. Y. Bulletin GET-1955, entitled "Welding and Metallurgical Aspects of Stainless Steels," consisting of a practical guide to better practices and results in arc-welding stainless steels. 31

BERYLLIUM AND ITS ALLOYS—Beryllium Corporation, Reading, Pa. Product directory covering in concise form the Berylco products made by the company, such as master alloys, beryllium copper wrought products, and casting ingots. 32

CARBON-GRAPHITE—United States Graphite Co., Saginaw, Mich. Catalogue containing 66 pages of technical information on Graphitar, a versatile engineering material for seals, bearings, end plates, valves, piston liners, and other parts. 33

TOOLS FOR SCREW MACHINES—Barnaby Mfg. Co., Inc., Bridgeport, Conn. Leaflet descriptive of Barnaby rotary stock stops for screw machines and turret lathes, floating holders, tap holders, and hinged-shoe bushing blanks. 34

UNIVERSAL AND TOOL GRINDER—Landis Tool Co., Waynesboro, Pa. Catalogue K-53, describing the Landis 12- by 28-inch universal and tool grinder. Illustrated are operating features, equipment, and typical grinding operations. 35

FORGINGS—Consolidated Industries, Inc., West Cheshire, Conn. Folder outlining the company's facilities for producing forgings of titanium, aluminum and alloy steels, and sand castings of aluminum and aluminum alloys. 36

INCLINABLE PRESSES—Niagara Machine & Tool Works, Buffalo, N. Y. Bulletin 58-L, illustrating and describing the company's line of open-back inclinable presses, equipped with mechanical sleeve clutches. Design features are explained. 37

TRACING TEMPLATES—Northwestern Tool & Engineering Co., Dayton, Ohio. Condensed tracing template for jig and fixture components, covering 263 items in full scale on a single sheet, for the handy use of tool designers. 38

LUBRICANTS—Sun Oil Co., Philadelphia, Pa. Technical Bulletin 17, giving physical properties and advantages of the new Solnus oils for general lubrication of a wide variety of industrial equipment. 39

LATHE TRAINING FILMS—South Bend Lathe Works, South Bend, Ind. Bulletin 5230, describing three films that are available from the company: "The Metalworking Lathe," "plain Turning," and "Grinding Cutter Bits." 40

CHAINS AND SPROCKETS—Chain Belt Co., Milwaukee, Wis. Bulletin 53-110, consisting of 56 pages of information on Rex cast and steel chain, cast tooth sprockets, belt conveyor idlers, and spray nozzles. 41

INDUSTRIAL DIAMONDS—Industrial Diamond Association of America, New York City. Booklet entitled "The Diamond That Pays for Itself," showing the principal uses of industrial diamonds throughout industry. 42

CEMENTED CARBIDES—Kennametal, Inc., Latrobe, Pa. Bulletin C-53, giving technical data on Kennametal and Kentanium, including mechanical and physical properties. Examples of typical applications are shown. 43

RECONDITIONING WELDERS—Lincoln Electric Co., Cleveland, Ohio. Bulletin 480, describing a new operating division established by the company for reconditioning and rebuilding Lincoln arc-welding equipment. 44

PRESSES—Minster Machine Co., Minster, Ohio. Leaflets descriptive of Minster single-crank straight-side presses (51) and of the double-crank straight-side presses (52) made by the company 45

FACILITIES FOR METAL-FABRICATING—L. O. Koven & Brother, Inc., Jersey City, N. J. Bulletin 550, illustrating a wide variety of specialized equipment manufactured by the company from practically every metal. 46

CARBIDE TOOLS—Wendt-Sonis Co., Hannibal, Mo. Catalogue 53, giving the features and applications of a complete line of carbide-tipped reamers, drills, milling cutters, tool bits, and other tools. 47

TOOL-HOLDERS—Metal Carbides Corporation, Youngstown, Ohio. Circular KL-53, describing the Klamp-Lok tool-holder for use in heavy-duty turning applications on lathes, boring mills, and planers. 48

SHEAR-SPEED GEAR SHAPING—Michigan Tool Co., Detroit, Mich. Bulletin SP-53, telling where, when, and how the Shear-Speed gear shaping process fits into the economical planning of today's metal-working plant. 49

LUBRICANTS FOR NORDSTROM VALVES—Rockwell Mfg. Co., Pittsburgh, Pa. Bulletin V-220, containing data on the characteristics of Rockwell lubricants for Nordstrom valves. A selection chart is included. 50

INDUSTRIAL BRUSHES—Pittsburgh Plate Glass Co., Brush Division, Baltimore, Md. Booklet presenting twelve typical installations in which Pittsburgh engineers have solved difficult brushing problems. 51

MEASURING INSTRUMENT—Sorensen Center-Mikes, Inc., Bridgeport, Conn. Bulletin 652, descriptive of the Center-Mike, an instrument for finding distance between centers of holes. 52

HACK- AND BAND-SAW BLADES—G. W. Griffin Co., Franklin, N. H. Catalogue 700, containing helpful information on the proper selection and use of hand and power hack-saw blades and band-saw blades. 53

NEMA MOTOR STANDARDS—General Electric Co., Schenectady, N. Y. Bulletin GEA-5995, containing complete information on the new NEMA motor standards and comparing them with the old standards. 54

PRESS-ROOM EQUIPMENT—Durant Tool Supply Co., Providence, R. I. Catalogue descriptive of Durant press-room equipment, including new slide feeds and press guards, and an enlarged line of stock straighteners. 55

PUSH-BUTTON UNITS—General Electric Co., Schenectady, N. Y. Bulletin GEA-5779, describing and illustrating the General Electric line of oil-tight push-buttons. Included are ratings and dimension diagrams. 56

SURFACE INDICATORS—Brush Electronics Co., Cleveland, Ohio. Folder describing the Brush Surfindicator, a new, portable gage for simplifying the measurement of surface roughness. 57

BEARING MOUNTING AND REMOVAL SYSTEM—S K F Industries, Inc., Philadelphia, Pa. Bulletin 344, describing a hydraulic system for mounting and removing bearings. Practical applications are given. 58

AUTOMATIC TURRET LATHES—Potter & Johnston Co., Pawtucket, R. I. Bulletin 151, on the 3-U Potter & Johnston automatic turret lathe for producing small, precision parts. 59

Product Information Service

Use the postage-free postcard below for requesting further information on New Catalogues. Simply circle the numbers of the items in which you are interested. Please print your name and address.

PLEASE SEND US MORE INFORMATION. Circle below item numbers on which you wish further information.

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M-8/53

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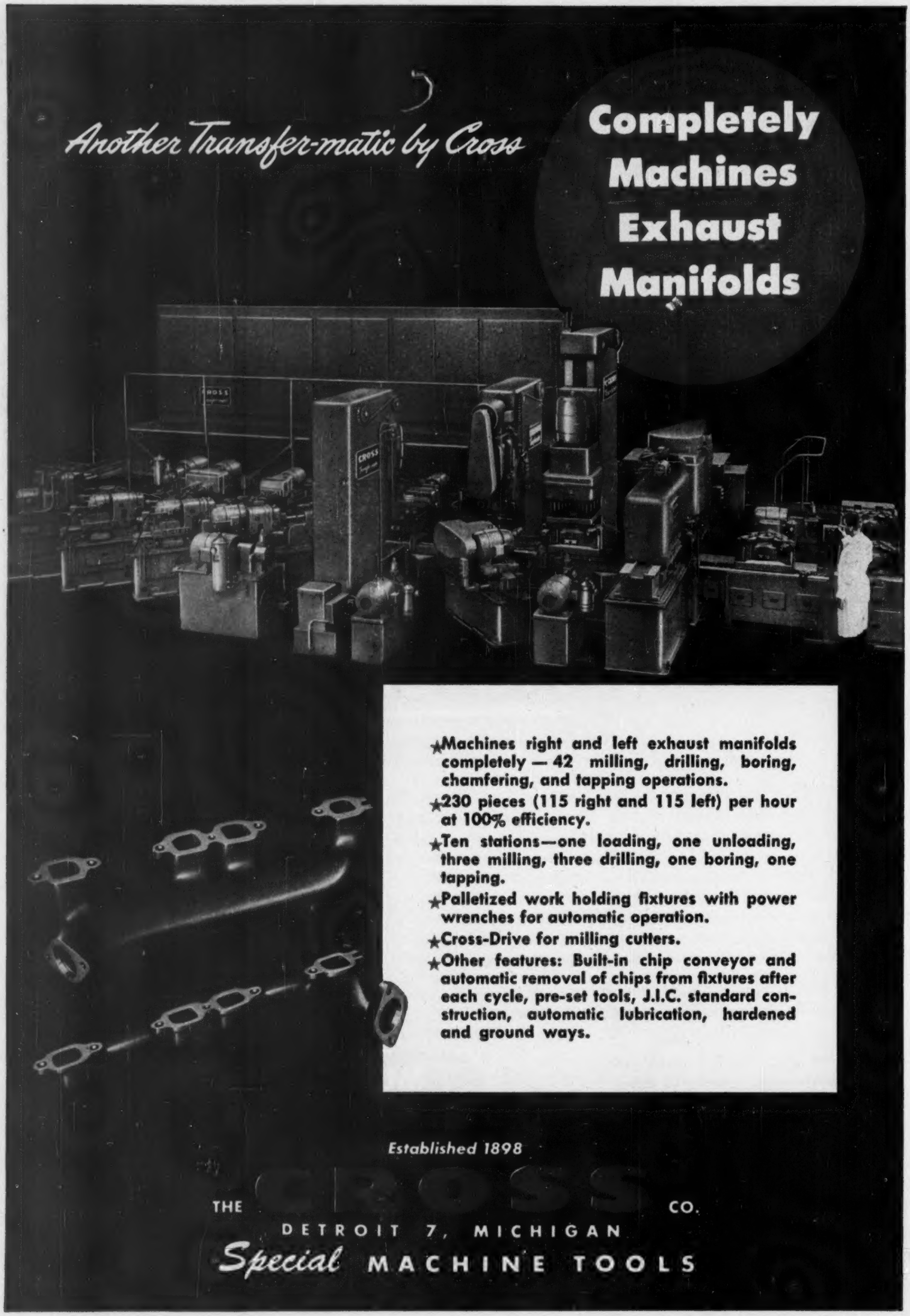
Another Transfer-matic by Cross
Completely Machines Exhaust Manifolds
★Machines right and left exhaust manifolds completely — 42 milling, drilling, boring, chamfering, and tapping operations.
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★Ten stations—one loading, one unloading, three milling, three drilling, one boring, one tapping.
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★Other features: Built-in chip conveyor and automatic removal of chips from fixtures after each cycle, pre-set tools, J.I.C. standard construction, automatic lubrication, hardened and ground ways.
Established 1898
THE CROSS CO.
DETROIT 7, MICHIGAN
Special MACHINE TOOLS

Between Grinds

By E. S. Salichs

No Truck to Buck

In an effort to promote week-end highway safety, the Timken Roller Bearing Company is following this rule: no inbound and outbound truck shipping between midnight, Friday, and midnight, Sunday, except for extreme emergencies. In June, for instance, 249 truck loads that normally would have gone out over the week-ends were rescheduled—and without impairing production schedules.

Wages for Sages

High school teachers, seventy-five of them, are taking an industrial course this summer on up-to-date techniques in the machine shops of the Chrysler Corporation. They are getting advanced college credits for the course, with the added incentive for not playing hooky of being paid for forty hours' work each week of the course.

Comin' Thru the Tube

The pneumatic tube system at the Lamson Corporation is used for an assortment of items—small tools, hot metal from the alloying department on its way to the laboratory, and even cold drinks from the refrigerator on their way to thirsty employes in remote departments. It's getting so if a worker sends an S. O. S. for dogs, the rejoinder will be "hot, cold, or a Chihuahua?"

How About Sending Some Mold-Making Machinery?

Thred-O-Matics ordered by the United Nations have now been shipped to maintenance shops in a new penicillin plant in India.

Beware the Beam!

Taking a tip from Paul Revere maybe, who swung a lantern to warn people, danger spots in noisy plant areas are now protected by means of high-intensity light beams rotating in wide, sweeping arcs.

A Mouthful a Minute

The Hulett ore unloader, described as a "mechanical pelican" in June *Steelways*, dips into ore in 18-ton bites, taking one bite every minute as it removes cargoes from ships and dumps them into railroad hopper cars.

Detector Dick

The Private Eye is a portable electronic detector made by the Radiac Co. that will locate buried metals and minerals, including gold and silver, and is as simple to operate as an ordinary radio. Pack one when you go to the mountains on vacation and maybe you'll pay the hotel bill in nuggets!

The Men of Measure

"A new breed of men has appeared over the horizon of American industry—they have a pair of calipers in one hand and a stop watch in the other." So does the American Standards Association describe the standards officials now operating for economy in large plants. For example, DuPont has saved $4 net for every $1 spent on American standards since its standards committee was started in 1947, while G-E has reduced the cost of aircraft instrument generators by 21 per cent and speed indicators by 18 per cent.

Modeling an apron made of glass-coated cloth so tough that it can stop a .38-caliber bullet fired from 8 feet away. The apron, which is considered form-fitting, perhaps does not do justice to the young lady, but it does protect employes in the Lockheed machine shops in Burbank, Calif., against metal particles that may fly from high-speed milling and cutting equipment.

The King of Spades

A spade made of titanium was used to break ground for the Westinghouse research center—to symbolize progress with new materials. The spade is the only one of its kind in the world, and it is doubtful whether it will be left in the barn for neighbors to borrow.

News OF THE INDUSTRY

California and Washington

RICHARD J. BENEFIEL has been appointed salesman and assigned to the Pacific District by the Carboloy Department of the General Electric Co. His headquarters will be at Huntington Park, Calif., and he will cover San Francisco and northern California, Oregon, and Washington.

ALLOY RODS CO., York, Pa., has begun construction of a new plant located in El Segundo, Los Angeles County, Calif., for the production of a complete line of alloy arc-welding electrodes to serve the Pacific Coast and Rocky Mountain States.

BONE ENGINEERING CORPORATION, Glendale, Calif., electronics manufacturer, announces the purchase of the CENTRIFUGAL INVESTMENT CASTING CO., Burbank, Calif., producer of both centrifugal and investment "lost wax" castings.

HOWARD D. NEAL, general manager of the Aerol Co., Inc., Los Angeles, Calif., manufacturer of wheels and casters, has been promoted to the office of vice-president and general manager.

GENERAL ELECTRIC COMPANY, Schenectady, N. Y., has announced the following appointments in the Pacific Northwest District, with headquarters at Seattle, Wash. J. S. LESTER, manager of sales; H. R. LOEW, manager of apparatus and component product sales; and T. M. PURTON, manager of marketing research.

HARRY A. HAUSER has been named Pacific Northwest sales representative for the Alloy Tube Division, Union, N. J., of the Carpenter Steel Co. Mr. Hauser is located in Richland, Wash.

A. MILNE & CO., New York City, tool steel distributors, has opened a sales office at the White Henry Stuart Bldg., Seattle, Wash. S. ROBERT SIMONDS will manage the office.

Illinois, Indiana and Iowa

HAROLD B. RESSLER, chairman of the executive committee of Joseph T. Ryerson & Son, Inc., Chicago, Ill., has retired from active service with the company. He remains a director. Mr. Ressler was second oldest in point of service of all Ryerson employes, having joined the organization in 1905. He occupied many positions of responsibility. For fifteen years he managed the St. Louis, Mo., plant, was general manager of sales of all plants in 1929, and three years later, was elected vice-president in charge of sales. From 1934 to 1944, Mr. Ressler served as manager of New York City operations and supervisor of plants at Boston, Philadelphia, and Buffalo. He then transferred to executive headquarters in Chicago and was elected first vice-president in 1950, and chairman of the executive committee two years later.

Harold B. Ressler, retiring chairman of the executive committee of Joseph T. Ryerson & Son, Inc.

GENERAL ELECTRIC CO., Schenectady 5, N. Y., announces the following appointments in the Central District in Chicago, Ill., of the Apparatus Sales Division: S. M. VANCE, manager of sales; G. D. DOWNING, manager of apparatus product sales; J. M. MCNULTY, manager of component products sales; J. W. BLAKE, manager of agency and distributor sales; and W. J. CURRY, acting manager of advertising and sales promotion. W. A. KNIGHT was named manager of the Peoria, Ill., office.

BARBER-COLMAN CO., Rockford, Ill., announces the opening of two factory branch offices for the Automatic Control and Uni-Flo Divisions: at 218 Harrison St., Syracuse, N. Y., with K. C. WATSON as manager; and at 1143 Mary St., Jacksonville, Fla., with D. W. MINICK as manager. Both offices will handle the sale and service of automatic control and air distribution products.

SET SCREW & MFG CO., Bartlett, Ill., announces that it has acquired from the Shakeproof Division of Illinois Tool Works, Chicago, Ill., the facilities for the manufacture and sale of the line of offset self-locking set screws formerly marketed by Shakeproof. This screw will now be known as the Setko offset self-locking set screw.

SCULLY-JONES & CO., Chicago, Ill., recently named three new distributors: E. A. KINSEY CO., INC., 725 N. Capitol Ave., Indianapolis 4, Ind., headed by J. P. KLINGER, branch manager; J. M. TULL METAL & SUPPLY CO., INC., 285 Marietta St., N. W., Atlanta, Ga.; and E. A. KINSEY CO., INC., 1020 W. 5th Ave., Columbus, Ohio.

MICRO DIVISION OF MINNEAPOLIS-HONEYWELL REGULATOR CO., Freeport, Ill., announces that a new factory will be opened shortly at Warren, Ill., to expand its production. The plant will occupy a 10,000-square foot building.

BRYANT MACHINERY & ENGINEERING CO. announces the removal of its general office to 640 W. Washington Blvd., Chicago 6, Ill.

R. L. SCHUTTE has been named sales manager, and P. H. STAERK, advertising manager, of the Ahlberg Bearing Co., Chicago, Ill.

CONANT TOOL & ENGINEERING CO., Chicago, Ill., announces the change of its firm name to CONANT BROACH CO.

PRODUCT ENGINEERING CO., INC., Columbus, Ind., announces that its Seymour branch, located at 105 S. O'Brien St., Seymour, Ind., will now be known as the KING INDUSTRIAL CORPORATION.

CARL L. ERWIN was recently advanced to the position of assistant works manager of Edward Valves, Inc., East Chicago, Ind., subsidiary of the Rockwell Mfg. Co., Pittsburgh, Pa.

ROBERT L. SCHWAEGERLE, abrasive engineer in the eastern Iowa territory of the Norton Co., Worcester, Mass., recently retired. He will be

Moen Single-Handle Faucet, made by Moen Valve Co., Division of Ravenna Metal Products Co., Seattle 5, Washington.

Sketch showing operation of Moen Faucet, which can be operated by one hand, giving water at the desired temperature at any rate of flow. You can change volume without changing temperature, or change temperature without changing volume, or select the desired temperature before turning on the water. Available in various styles and types.

Faucet maker finds **unit cost more important** than cost per pound

This Moen Faucet is unusual. First, its design represents a new idea in faucets so far as we know. If we are wrong, we will welcome the correction. But in any event, this modern faucet is selling like mad; people really want its convenience, its simple operation, its one-hand control. The second unusual thing about the faucet is that the spout is made of Admiralty Metal, supplied by Revere. This metal was chosen by Moen after consultation with the Revere Technical Advisory Service, which pointed out the qualities of Admiralty from the standpoints of bendability, and plating characteristics. Everything considered, the "more expensive" Admiralty turned out to be less expensive in the end, and more satisfactory both to the Moen Valve Co. and to its customers. The faucet also uses Revere Free-Cutting Brass Rod for interior machined parts, this again being chosen for workability and corrosion resistance. Service to Moen and to many other industries in the Mountain State area is of course provided by the Revere sales, technical and mill personnel on the Pacific Coast. Similar services are of course available from Revere everywhere in this great country. To obtain the Revere services, see the nearest sales office.

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, N. Y.

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Mills: Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.—Sales Offices in Principal Cities, Distributors Everywhere

SEE REVERE'S "MEET THE PRESS" ON NBC TELEVISION EVERY SUNDAY

succeeded by ROBERT H. JOHNSON, who has been with Norton since 1941. Mr. Schwaegerle was associated with the company for twenty-five years. In 1944, he was appointed an abrasive engineer in Iowa.

Michigan and Wisconsin

W. A. MOSTELLER has been named manager of sales for the Michigan District of the Apparatus Sales Division, General Electric Co., Schenectady, N. Y. F. T. SCOTT has been appointed manager of product sales, and H. H. HANDORF, manager of chemical, steel, and large users. E. I. LEBARON has been named manager of the Flint, Mich. office.

MILTON O. CROSS, JR., president of The Cross Co., Detroit, Mich., machine tool manufacturer, has been named to the executive committee of the National Metal Trades Association. He will also act as regional counselor in the Detroit area.

GOODRICH WELDING EQUIPMENT CORPORATION, manufacturer of resistance welding euipment, has moved from Reed City to Hudsonville, Mich., where a new factory is now being completed, having 19,880 square feet of manufacturing space.

GEORGE L. HUFFMAN, assistant sales manager in the Pure-Pak Division of the Ex-Cell-O Corporation, Detroit, Mich., has been promoted to the position of sales manager. Mr. Huffman has been with the concern since 1934.

METALS FINISHING CORPORATION, Hazel Park, Mich., was recently appointed distributor for the Honite line of barrel finishing products made by the MINNESOTA MINING & MFG. CO., St. Paul, Minn.

WEBER INSTRUMENT TESTING LABORATORY is a new physical testing laboratory which has been opened at 13845 Elmira, Detroit, Mich.

ROY RUMBAUGH has been named director of sales engineering for Klem Chemicals, Inc., Dearborn, Mich.

BJORKSTEN RESEARCH LABORATORIES, INC., New York City, announces that a new laboratory building will be completed in the fall at Madison, Wis. Work in the laboratory will consist largely of research in the plastics and polymer field.

A. W. PLIER was recently named president and general manager of the D. J. MURRAY MFG. CO., Wausau, Wis., succeeding F. C. BOYCE. Mr. Boyce, who was president of the company since 1933, has now become chairman of the board.

New England

CHARLES M. POND and HUBERT D. TANNER, vice-presidents and directors of Pratt & Whitney Division of Niles-Bement-Pond Co., West Hartford, Conn., have retired. Mr. Pond began his career with Pratt & Whitney in 1903. Nine years later, he was placed in charge of the first company office in Cleveland, Ohio, for the sale of small tools. He later was recalled to Hartford and appointed sales manager of the Small Tool Division. Ten years after, he became manager of the small tool department; in 1928, he was made manager of the combined small tool and gage departments. Mr. Pond was elected a vice-president and director in 1939. Mr. Tanner, who was associated with the company for thirty-three years, started as a machine designer specializing in the development of grinding machine and thread milling machines. He was appointed manager of the machinery department in 1935, and four years later was elected a vice-president and director. Pratt & Whitney has also announced at this time the following promotions: RICHARD W. BANFIELD, a vice-president, succeeding Mr. Pond as manager of the Small Tool and Gage Division; EDWARD N. CLARK, superintendent of the Small Tools Division; HAROLD G. LUCAS, superintendent of the Gage Division; WILLIAM R. BACK, superintendent of aircraft parts manufacture; ALBERT L. KNAPP, general superintendent, EDWARD J. FERRIS, assistant general superintendent, and EDWARD J. SHAGES, manufacturing superintendent, all three in the Machinery Division; and SANFORD G. ETHERINGTON, JR., supervisor of planning.

(Left to Right), Hubert D. Tanner and Charles M. Pond, vice-presidents and directors of Pratt & Whitney, Division Niles-Bement-Pond Co., who are retiring

CLARENCE G. ROSENSWEIG has been elected executive vice-president, and RICHARD F. COOPER, vice-president and works manager, of the Fafnir Bearing Co., New Britain, Conn. Mr. Rosensweig was chief manufacturing executive of the company at the time of his appointment. This position is now being filled by Mr. Cooper in his new capacity. Mr. Rosensweig started with Fafnir in 1916 as an engineer of the production department, and Mr. Cooper in 1934 as a time study man.

RALPH EDWARDS has joined the Hanson-Whitney Co., Hartford, Conn., in the capacity of general sales manager—machine tools. Prior to joining the company, Mr. Edwards was New York City branch manager for the Keller Tool Co., Grand Haven, Mich. Also announced was the promotion of EDWARD P. CODY from sales manager to general sales manager—small tools and gages.

PREFERRED BEARING CO., Bristol, Conn., has been acquired by WALTER P. JACOB, who will become president of the new company, which will be known as the BRISTOL BEARING CO. FRED WEBER, who headed the Preferred Bearing Co., will continue as vice-president and production manager under the new ownership.

RAYMOND J. NAGY was recently named sales rerpesentative in Connecticut for the Adamas Carbide Corporation, Harrison, N. J., manufacturer of standard carbide tools, tool tips, dies, and wear parts. Mr. Nagy is located at Simsbury, Conn.

A. J. MOORE was recently named manager of sales for the New England District of the Apparatus Sales Division, General Electric Co., Schenectady, N. Y. Other appointments for this district, whose headquarters are at Boston, Mass., are as follows:

(Continued on page 257)

NOW 4 TYPES
295 SIZES
Starrett®
precision ground
FLAT STOCK AND DIE STOCK

NO. 497 AIR HARDENING
NO. 496 OIL HARDENING
NO. 495 OIL OR WATER HARDENING
NO. 495 WATER HARDENING

Save time. Save money. Save valuable man and machine hours. Use Starrett precision ground Die and Flat stock for all precision parts, pieces, punches, dies and special tools having two flat, parallel sides. Just select the right type and size of flat stock from the complete Starrett line . . . lay it out . . . and saw it out. (For best cutting, use Starrett Band Saws.)

Keep a supply of frequently used sizes in the tool crib . . . or call your Industrial Distributor for prompt, dependable, quality service.

LOOK FOR THE MARK OF PRECISION
Starrett®
STAMPED ON EVERY PIECE

Each piece is marked for type and size and individually packaged in a protective envelope showing chemical analysis, hardening and tempering information.

WRITE FOR NEW FOLDER AND WALL CHART
listing the 295 sizes available and giving hardening formulas for the four types. Address Dept. D

STARRETT TOOLS
TRADE MARK
Starrett
REG. U.S. PAT. OFF.
SINCE 1880
WORLD'S GREATEST TOOLMAKERS

THE L. S. STARRETT COMPANY
Athol, Massachusetts, U. S. A.

MECHANICS' HAND MEASURING TOOLS AND PRECISION INSTRUMENTS
DIAL INDICATORS • STEEL TAPES • PRECISION GROUND FLAT STOCK
HACKSAWS, BAND SAWS and BAND KNIVES

Buy
THROUGH YOUR
INDUSTRIAL DISTRIBUTOR
Prompt delivery
Dependable service
Quality products

S A E STANDARD SINGLE-WALL STEEL TUBING

This specification covers single-wall steel tubing used for automotive and other similar purposes, made from a single strip of steel into a tubular form, the edges of which are butt-welded together. The tubing shall be annealed after welding and the bead removed from the outside to produce tubing of required strength, smooth and round. A slight bead on the inside is permissible but must be held to the minimum consistent with good welding.

Surface of the tubes shall be clean, smooth, and round both inside and outside. Tubing shall be made from low-carbon steel, with the following physical properties:

Yield strength, pounds per square inch, minimum 28,000
Ultimate strength, pounds per square inch, minimum ... 42,000
Elongation in 2 inches, per cent .... 14 to 40
Hardness (Rockwell 30T scale), maximum 68

The tubing shall be capable of being formed into various shapes and adaptable to various types of mechanical connections, such as being flared without splitting.

The tubing shall bend on a radius of three times the outside diameter without undue reduction of area or flattening when correct bending fixtures are used.

Standard Sizes, Dimensions, and Tolerances for Single-Wall Steel Tubing

Size, Inch	Actual Outside Diameter, Inch	Wall Thickness, Inch	Tolerances on Average Outside Diameter, Inch*
1/8	0.125	0.025	±0.002
3/16	0.188	0.025	±0.002
1/4	0.250	0.028	±0.003
5/16	0.312	0.028	±0.003
3/8	0.375	0.028	±0.003
7/16	0.437	0.030	±0.004
1/2	0.500	0.030	±0.004
1/2	0.500	0.035	±0.004
9/16	0.562	0.030	±0.004
5/8	0.625	0.035	±0.004

*Dimensional tolerances on wall thickness are:
For tubes up to 1/4-inch size .... ±0.005 inch
For tubes 1/4-inch size and over .... +0.002, −0.003 inch

Static Pressure Proof Test for Single-Wall Steel Tubing

Tube Size, Inch	Static Pressure Proof Test, Pounds per Square Inch
1/8 to 3/8, inclusive	5000
7/16 to 5/8, inclusive	1000

S A E STANDARD DOUBLE-WALL STEEL TUBING

This specification covers double-wall steel tubing used for automotive and other similar purposes, made from a single or double strip of steel into the form of a double-wall tubing, and the seams are copper brazed in a controlled atmosphere. The braze shall be uniform with no evidence of a bead on either the inside or outside.

Surface of the tubes shall be clean, smooth, and round both inside and outside. Tubing shall be made from low-carbon steel, with the following physical properties:

Yield strength, pounds per square inch, minimum 28,000
Ultimate strength, pounds per square inch, minimum ... 42,000
Elongation in 2 inches, per cent .... 14 to 40
Hardness (Rockwell 30T scale), maximum 68

The tubing shall be capable of being formed into various shapes and adaptable to various types of mechanical connections, such as being double flared without splitting.

The tubing shall bend on a radius of three times the outside diameter without undue reduction of area or flattening when correct bending fixtures are used.

Standard Sizes and Dimensions of Double-Wall Steel Tubing

Size, Inch	Actual Outside Diameter, Inch	Wall Thickness, Inch
1/8	0.125	0.025
3/16	0.188	0.025
1/4	0.250	0.028
5/16	0.312	0.028
3/8	0.375	0.028
7/16	0.437	0.032
1/2	0.500	0.035
5/8	0.625	0.035

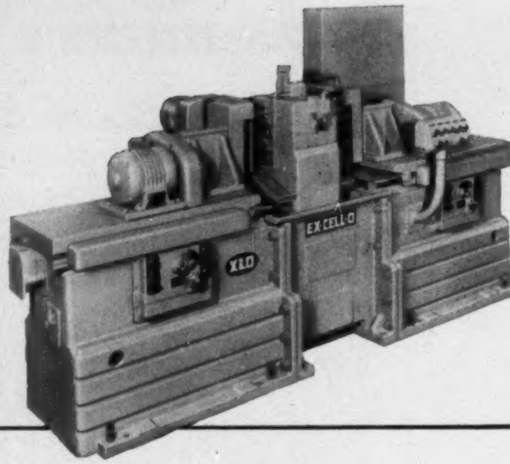
The dimensional tolerances of the standard tube sizes are as follows:
Outside diameter .... +0.002, −0.003 inch
Wall thickness up to 1/4-inch size .... ±0.005 inch
Wall thickness, 1/4-inch size and over .... +0.002, −0.003 inch

Static Pressure Proof Test for Double-Wall Steel Tubing

Tube Size, Inch	Static Pressure Proof Test, Pounds per Square Inch
1/8 to 3/8, inclusive	5000
7/16 to 5/8, inclusive	1000

822

PIECES PER HOUR



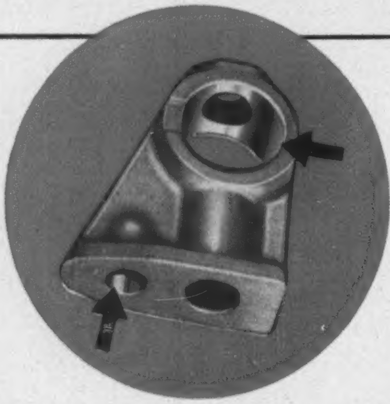


Photo above shows one of the die-cast aluminum workpieces. Arrows point to the bored holes which are held to plus or minus .0005". Four parts are machined during each cycle, netting 822 pieces per hour.

FROM THIS

EX-CELL-O

3-Way Machine

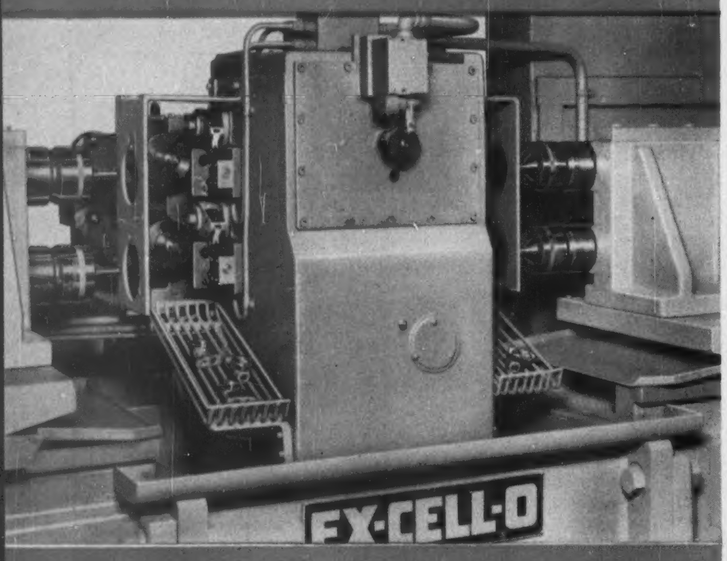
Works From 3 Directions Simultaneously

This Ex-Cell-O three-Way Precision Boring Machine consists of three standard, self-contained way units joined to a center section. The left and right way units have two spindles each, mounted one above the other on angle plate brackets. The rear unit carries four spindles, two on each side. The center section supports a fixture accommodating two parts on each side. Work is clamped and ejected hydraulically.

Ask your local Ex-Cell-O representative about all the other advantages of Ex-Cell-O Way Machines, or write today for Bulletin 31631.

XLO

EX-CELL-O for PRECISION



Two parts are held in each side of the fixture. Left and right slides bore 13/16" diameter hole through each part, while rear slide is boring 5/16" blind holes at right angles to the others. The work is unclamped and ejected automatically at the end of the machining cycle.

EX-CELL-O CORPORATION

DETROIT 32, MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS • CUTTING TOOLS
RAILROAD PINS AND BUSHINGS • DRILL JIG BUSHINGS • AIRCRAFT
AND MISCELLANEOUS PRODUCTION PARTS • DAIRY EQUIPMENT

53-22

A. SPLITTBERGER, manager of apparatus and component products sales; O. J. SCHOPP, manager of agency and distributor sales; A. R. WHENMAN, manager of electric utility sales; R. P. RICE, manager of industrial sales; E. S. GUNN, manager of transportation sales; and J. P. PATTON, manager, Providence, R. I., office.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces the following appointments in its welding department at Fitchburg, Mass.: CHARLES L. HELMS, manager of marketing administrative practices; AUSTIN HILLER, manager of marketing analysis and planning research; and AUSTIN LEACH, manager of renewal parts.

FRED DUFF has been appointed district manager in Chicago, Ill., for the Morse Twist Drill & Machine Co., New Bedford, Mass. Mr. Duff was formerly district manager in Cleveland, and in metropolitan New York City. REX BENNETT has been appointed district manager to succeed Mr. Duff in New York.

NORTON CO., Worcester, Mass., has established a job lapping department in order to broaden the company's capacity for handling job lapping projects.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces that the Welding Department, which has been located in Fitchburg, Mass., since 1946, will be transferred to York, Pa., by the end of March, 1954.

WILLIAM F. JENKINS has been appointed sales manager of the Butterfield Division of the Union Twist Drill Co., Derby Line, Vt., manufacturer of metal-cutting tools. He succeeds L. H. LAYTHE, who will continue as office manager and sales consultant. BLAINE T. HALL will assist Mr. Jenkins in sales promotion and advertising. JAMES T. MCFADGEAN becomes manager of the newly organized customer service department.

William F. Jenkins, sales manager of the Butterfield Division of the Union Twist Drill Co.

New York

GENERAL ELECTRIC CO., SCHENECTADY, N. Y., announces the following appointments to key industry sales posts in the Apparatus Sales Division; O. B. FALLS, JR., manager of electric utility sales; T. F. MACKEY, manager of heavy industries sales; K. R. ROSS, manager of medium industries sales; W. V. GOUGH, manager of light industries sales; H. R. WALLRATH, manager of contractor and construction industries sales; A. H. HEMKER, manager of farm, trade, and services industries sales; H. D. BEALE, manager of industry products maintenance; and F. W. MCCHESNEY, manager of industry sales procedures. All will be located at Division headquarters in Schenectady, N. Y.

ALLEN E. BAILEY, JR., an electronic control specialist in the industry control department of the General Electric Co., Schenectady, N. Y., recently retired after thirty-seven years of service. Mr. Bailey began his career with the company in 1916 when he was assigned to the drafting department. In 1929, he invented a thyratron lighing system which was installed in the Chicago Civic Opera House. Mr. Bailey holds patents on that installation and has six other electrical patents. In 1945, he became sales manager for the electronic control section. Recently, he helped develop the application of selsyns for three-dimensional motion picture projection.

OAKITE PRODUCTS, INC., New York City, announces the following changes in management: H. LIGGETT GRAY was elected to the office of second vice-president; FRANK L. OLDROYD was named vice-president, a post he will hold in addition to his present position of general sales manager of the industrial division; EUSTACE LINGLE and VAN DORN C. SMITH were made vice presidents; and GEORGE M. SEIB, assistant manager, was promoted to the office of secretary of the company.

WILLIAM F. OSWALT, who was manager of manufacturing for the industry control department, has been named general manager of a newly established general-purpose control department of the General Electric Co., Schenectady, N. Y. This department is assuming all responsibility for the general-purpose control business formerly assigned to the Switchgear and Control Division. Other appointments made in this department are as follows: JAMES W. COOKE, manager of engineering; DONALD G. CAMERON, manager of Schenectady manufacturing; and FRED H. HOLT, marketing manager.

KENNETH C. SPOONER, sales manager of the Simmons Machine Tool Corporation, Albany, N. Y., rebuilder of machine tools and manufacturer of special-purpose machinery, has been named vice-president. Mr. Spooner has been with the Simmons organization for more than fifteen years.

H. L. INGRAM, JR., special representative in Washington, D. C., has been appointed manager of the technical development department of the Air Reduction Sales Co., New York City, a Division of Air Reduction Co., Inc.

EDWARD LEMAIRE was recently appointed sales engineer for the drill steel division of the Crucible Steel Co. of America, New York City, his territory covering the eastern United States.

ARTHUR V. PETERSON, formerly with the Atomic Energy Commission, has joined the staff of the vice-president in charge of engineering of the American Machine & Foundry Co., New York City.

New Jersey

ANTHONY A. MIANO recently joined the Cooper Alloy Foundry Co., Hillside, N. J., in the capacity of standards supervisor in the Stainless Engineering & Machine Works Division. MORTON L. KATZ has become chief shell mold engineer in the Shell Mold Division, and JOHN L. KEATING has become associated with the company, in the post of production manager.

ALBERT H. BORCHARDT, vice-president of the Worthington Corporation, Harrison, N. J., has retired after forty-four years of service with the concern.

ROBERT F. ELMIGER has been appointed sales analyst for the Alloy Tube Division, Union, N. J., of the Carpenter Steel Co.

D. R. STROUSE, who recently joined the Tube Reducing Corporation, Wallington, N. J., has been made production manager.

A. K. RUNKLE has become superintendent of the Friction Division of the Thermoid Co., Trenton, N. J. Mr. Runkle takes over the former duties of CARL P. BROCKWAY, who was recently elected president of the company's subsidiary, ASBESTOS MFG. Co., Huntington, Ind.

JOHN J. MCGONAGLE has become manager of steel sales for the Edgcomb Steel Corporation, Hillside, N. J., which is an aluminum and steel distributor.

Ohio

GENERAL ELECTRIC Co., Schenectady, N. Y., recently made the following appointments in the East Central District which is located in Cleveland Ohio, of the Apparatus Sales Division: E. H. HOWELL, manager of sales; R. C. HARDY, manager of industry sales; G. J. CLARK, manager of apparatus product sales; C. J. MILLER, manager of component product sales; and R. E. BOYLE, manager of the Cleveland, Ohio, office. Also announced were the following local appointments in Cleveland: E. F. TAGGERT, manager of electric utility sales; P. C. SHIRKEY, manager of heavy industry sales; K. F. CULLER, manager of medium industry sales; P. S. SALSTROM, manager of light industry sales; and R. A. HAMMOND, manager of engineering.

NORMAN W. FOY was recently elected vice-president in charge of sales of the Republic Steel Corporation, Cleveland, Ohio. He succeeds J. M. SCHLENDORF, who is retiring but continuing in a consulting capacity on sales problems. Mr. Foy has been associated with the Republic Steel Corporation since its formation in 1930 when he was appointed Chicago district sales manager. In 1937, he was made general manager of sales. Mr. Schlendorf was also associated with the corporation from its beginning, and in 1945 was made sales vice-president. L. S. HAMAKER has now become general manager of sales, succeeding Mr. Foy.

GEORGE R. LUNDBERG, assistant sales manager in the Brush Division of the Osborn Mfg. Co., Cleveland, Ohio, has been promoted to the post of sales manager. Mr. Lundberg has been a member of the Osborn organization for twenty years, serving in many executive capacities, both in the Molding Machine Division and the Brush Division. Other promotions announced by the company are as follows: FREDERIC T. TURNER, formerly assistant sales manager, has been named manager, market research; EVERETT A. SISSON, sales project supervisor, has been made assistant sales manager; ALFRED J. CHANDLER, assistant manager, industrial sales, has been named manager, industrial sales; and C. A. DOLBY, advertising and sales promotion manager, has been promoted to manager, distributor sales.

RANDOLPH J. ROSHIRT has joined Aluminum Industries, Inc., Cincinnati, Ohio, in the capacity of vice-president. He will be responsible for integrating production and sales operations. Mr. Roshirt was formerly executive vice-president of the Bohn Aluminum & Brass Corporation, Detroit, Mich., with which company he was associated for thirty-four years.

AMERICAN STEEL & WIRE DIVISION OF THE UNITED STATES STEEL CORPORATION, Cleveland, Ohio, announces that a rod mill will be constructed at the present Cuyahoga Works in Cleveland, to increase the plant's rod production. The new facilities will have a rated capacity of 450,000 tons per year compared to the present equipment which has a rated capacity of 313,000 tons per year.

M. J. HOKE was recently appointed general manager of the Crankshaft and Camshaft Division of the Ohio Crankshaft Co., Cleveland, Ohio. Mr. Hoke joined the company in 1945 as a development engineer. Two years later, he was made chief engineer, and the following year, works manager.

CHARLES E. HOWES has been made general manager of sales for the Berger Mfg. Division, Canton, Ohio, of the Republic Steel Corporation, Cleveland, Ohio, succeeding R. W. HELMS, who was transferred to Cleveland and made assistant general manager of sales for the entire organization. Mr. Howes was formerly manager of sales in the steel equipment division, this position now being filled by D. E. GEORGE. Until this appointment, Mr. George was manager of the New York sales branch for the Berger Mfg. Division.

FEEDALL MACHINE & ENGINEERING Co. recently moved from 29 Elm St. to 38399 Pelton Road, Willoughby, Ohio. The company designs and builds automatic hopper feeds and similar special selector devices. Also announced were the appointments of RICHARD H. CROTTY as chief engineer and CLAUDE C. SOWERS as production manager.

CHARLES W. GINSBERG was recently named president of the Babcock Printing Corporation, Canton, Ohio, printing press manufacturer.

DONALD O. WYNOCKER has joined the J. N. Fauver Co., Inc., Detroit, Mich., becoming Toledo and northwestern Ohio representative.

RUDOLPH WINTERS was recently appointed superintendent of the Hamilton, Ohio, plant of the Clearing Machine Corporation, Chicago, Ill., manufacturer of power press equipment. Mr. Winters joined the Clearing organization in 1940 and was, until recently, a foreman at the Chicago plant.

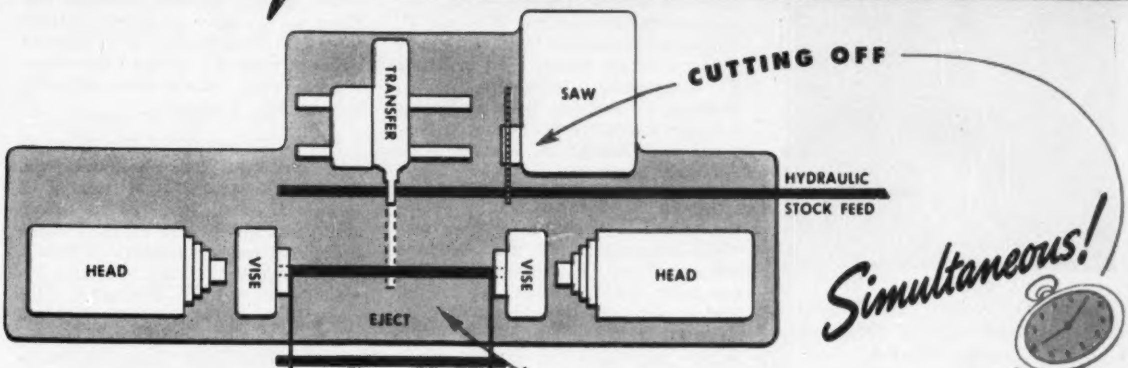
George R. Lundberg, who has become sales manager in the Brush Division of the Osborn Mfg. Co.

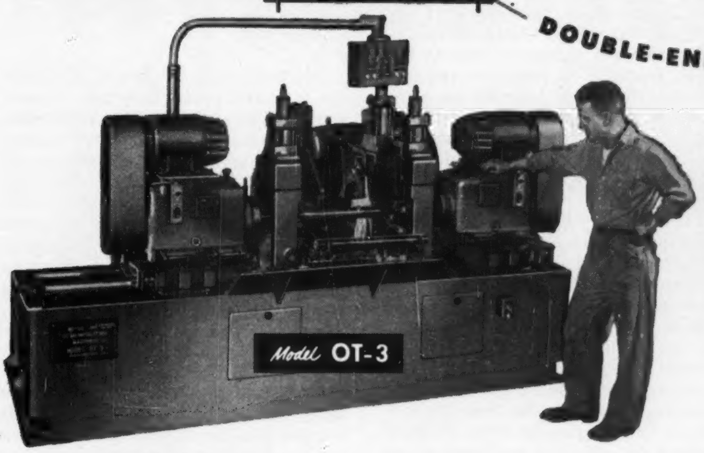
M. J. Hoke, general manager of the Crankshaft and Camshaft Division of the Ohio Crankshaft Co.

Rudolph Winters, superintendent of the Hamilton, Ohio, plant of the Clearing Machine Corporation

Variety..

CUT OFF while you DOUBLE-END MACHINE on MOTCH & MERRYWEATHER AUTOMATIC TRANSFER MACHINES!





BORE • FACE • CHAMFER • CENTER DRILL • TURN • REAM • GROOVE and other operations, singly or "unitized"

MP/SF
Most Production per Square Foot

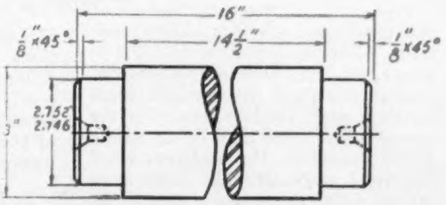
PRO RE DUCE PROFIT COSTS... Three or four machines in one. Cut off to accurate length and double-end machine simultaneously. Cut-off time is virtually "free". *Change-over quick from job to job!* Ideal for short or production runs. Cycle fully automatic. *Remember:* it's the cost per piece that counts.

Case Study No. 182

Operation: Cut off, box mill, turn and center drill both ends.

Material: SAE 1020.

Production: 110 pieces per hr.



SPECIFICATIONS

ITEM	Model OT-3	Model OT-4½	Model 2T-6
Rated diameter stock	½" to 3"	¾" to 4½"	1" to 6"
*Standard work length	8" to 40"	8" to 40"	8" to 40"
Weight (approximate)	11,500 lbs.	15,000 lbs.	26,000 lbs.

*Work length can be increased by special arrangement.
NOTE: Supplied for ferrous or non-ferrous applications.

Manufactured by — THE MOTCH & MERRYWEATHER MACHINERY CO. —
CLEVELAND 13, OHIO
Builders of Circular Sawing Equipment, Production Milling, Turning and Special Machines

PRODUCTION-WITH-ACCURACY MACHINES AND EQUIPMENT

Perrin G. March, III, Director of the Metal-Working Equipment Division of N.P.A.

PERRIN G. MARCH, III, president of the Cincinnati Shaper Co., Cincinnati, Ohio, has been appointed director of the Metal-Working Equipment Division of the National Production Authority. Mr. March replaces Earl P. Leeds, who returns to the Brown & Sharpe Mfg. Co.

REPUBLIC STEEL CORPORATION, Cleveland, Ohio, is soon starting erection of a new plant in Toledo, Ohio, which will have a capacity of 50,000 pounds per day for the commercial production of iron powder.

N. RANSOHOFF CO., producer of equipment for the surface treatment of metals, has moved from Elmwood, a Cincinnati, Ohio, suburb, to a larger plant in Hamilton, Ohio.

BULLARD CO., Bridgeport, Conn., announces that its Cleveland district office has now moved to 16828 Kinsman Road, Shaker Heights, Ohio.

DEVILBISS CO., Toledo, Ohio, has expanded its metal-working division by adding a separate building to house the division.

Oklahoma and Missouri

GRANT A. MORRISON has been appointed representative for the midwestern district of the Carboloy Department of General Electric Co., Detroit, Mich. Mr. Morrison is located at 3907 S. Madison, Tulsa, Okla.

E. H. SCHOONMAKER has become district manager at St. Louis, Mo., for the Eddystone Division of the Baldwin-Lima-Hamilton Corporation, Philadelphia, Pa. Mr. Schoonmaker was acting manager of the district at the time of his promotion.

Pennsylvania

KENNAMETAL, INC., Latrobe, Pa., announces the following appointments in its Metalworking Division: representatives—WALLACE T. ALLIN, Los Angeles, Calif., district office; WILLIAM W. LIND, Chicago, Ill., office; and MARK ROLLINSON and LEONARD SPICER, Detroit, Mich., office; service engineers—WILLIAM F. BARBOUR, Cincinnati, Ohio; EARLE S. CUMMINGS, St. Louis, Mo.; WARREN H. EISENBERG, Milwaukee, Wis., WARREN C. FOSTER, Detroit, Mich.; RAYMOND GUENTHER, Southern District; and ROBERT A. WELSH, New England District.

JAMES L. MACDOWELL, superintendent of the automatic screw machine department at the Standard Pressed Steel Co., Jenkintown, Pa., has been made manager of tooling and quality, succeeding ALBERT A. LEEDOM. Mr. Leedom has been assigned to the staff of Cooper Precision Products, a subsidiary of the company in Los Angeles, Calif. Other changes announced are as follows: HERBERT R. FESMIRE succeeds Mr. MacDowell as head of the automatic screw machine department, while MARK A. HAWKINS replaces Mr. Fesmire as general foreman in this department.

PITTSBURGH PLATE GLASS CO., Pittsburgh, Pa., announces the following appointments: H. B. WEED, manager of the Trenton, N. J., branch, succeeding R. A. MCMULLIN, who is on a special sales assignment in the Philadelphia branch; JOHN HENRY COON, JR., manager of the Reading, Pa., branch; JOHN H. BEATTY, manager of the Jackson, Miss., branch, succeeding EARL J. BIENVENU, who has returned to the New Orleans office to serve in a special sales capacity; and GEORGE P. MYERS, assistant general sales manager, industrial finishes, with headquarters at Pittsburgh. Mr. Myers succeeds CARL C. PATTERSON, who was recently transferred to the East Point (Atlanta), Ga., Paint Division.

DONALD I. BOHN, who was chief electrical engineer for the Aluminum Company of America, Pittsburgh, Pa., will now be in charge of special electrical development engineering work. He has been with the company for more than thirty years. LOUIS N. GRIER, the assistant chief electrical engineer, has been promoted, filling the vacancy created by Mr. Bohn's appointment. He also has been with the company for thirty years.

GENERAL ELECTRIC CO., Schenectady, N. Y., announces the following appointments made by the Apparatus Sales Division in the Atlantic district, whose headquarters are at Philadelphia, Pa.: N. L. WHITECOTTON, manager of sales; R. M. BLEAK, manager of marketing research; E. G. S. MAXWELL, manager of apparatus product sales; C. L. DAVISON, manager of industry sales; and H. W. ROBINSON, manager of agency and distributor sales. Mr. Whitecotton had been manager of the Philadelphia, Pa., office, this post now being filled by W. F. HENN, while W. C. MASON succeeds Mr. Henn as manager of electric utility sales for Philadelphia. C. R. STOUCH becomes manager of the Charleston, W. Va., office, the position formerly held by Mr. Maxwell.

DELTA POWER TOOL DIVISION OF THE ROCKWELL MFG. CO., Pittsburgh, Pa., announces the establishment of a new regional distribution set-up and the appointment of the following regional managers: BYRON COON, Oakland, Calif., Western Division; GEORGE H. MADESKA, Chicago, Ill., Central Division; WALTER H. REDPATH, Toronto, Ont., Canadian Division; and GEORGE E. ROCKWELL, New York City, Eastern Division.

AVIATION GAS TURBINE DIVISION OF WESTINGHOUSE ELECTRIC CORPORATION, Philadelphia, Pa., announces the following appointments: THOMAS A. DALY, manager of technical operations; HEWETT R. ARNOLD, assistant manager, technical operator; JOSEPH F. CHALUPA, manager of manufacturing for the South Philadelphia plant; JAMES W. FATKIN, assistant to the Division manager; and VINCENT J. GORDON, JR., assistant manager of production.

JAMES E. GRAY was recently appointed assistant manager of carbide sales for Firth Sterling, Inc., Pittsburgh, Pa. Mr. Gray, who has had twenty-four years' experience in the company's Carbide Division, was supervisor of carbide sales in the Chicago district at the time of his promotion. Also announced by the company was the appointment of STUART A. SMITH as Ohio district manager, replacing Macon Jordan, who has resigned.

C. I. BRADFORD has been appointed vice-president and director of operations of Rem-Cru Titanium, Inc., Midland, Pa. Mr. Bradford was formerly director of operations. W. E. GREGG, who was assistant treasurer of the company, has been named assistant director of operations.

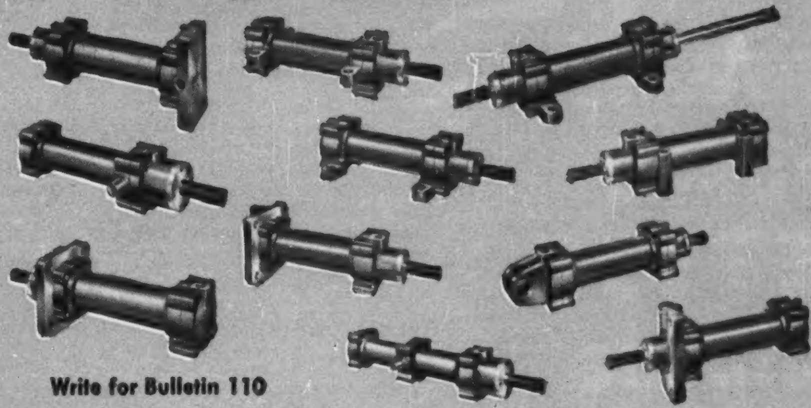
J. H. HORTON, who has rejoined the sales staff of the Niagara Machine and Tool Works, Buffalo, N. Y. after serving in the Armed Forces, will be associated with the Philadelphia district, which is located at Wynnewood, Pa.

ROBERT J. SIMES, assistant superintendent of the mechanical department at the Lukens Steel Co., Coatesville, Pa., has been promoted

FOR YOUR

SERIES "N" HYDRAULIC CYLINDERS

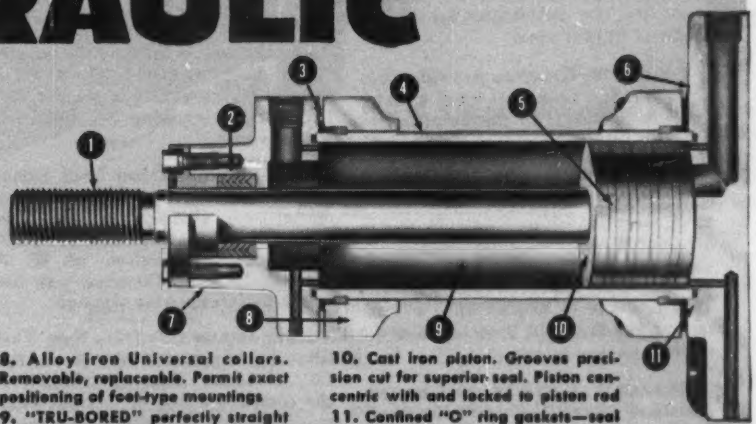
- Long recognized as the finest hydraulic cylinder made.
- No tie rods; ideal for long-stroke applications
- 12 bore sizes, 1" to 8"
- 11 mounting styles; many combination mountings available



Write for Bulletin 110

HYDRAULIC

ADVANTAGES



1. Ground steel piston rod. Concentric with and locked to piston
2. Pre-adjusted chevron packings in non-adjustable gland. This eliminates over-tightening, binding, etc.
3. Alloy steel bolts—heat-treated for strength
4. Seamless steel cylinder. Extra strength. Piloted to end caps to assure concentric assembly
5. Positive seal piston rings. Lapped both sides for minimum oil slip
6. Alloy iron Universal end caps. Rugged. Port completely rotatable—air vents four sides
7. Cushioned caps when specified. Eliminate shock at end of stroke
8. Alloy iron Universal collars. Removable, replaceable. Permit exact positioning of foot-type mountings
9. "TRU-BORED" perfectly straight and round, then honed satin smooth
10. Cast iron piston. Grooves precision cut for superior seal. Piston concentric with and locked to piston rod
11. Confined "O" ring gaskets—seal positively, cannot extrude

CYLINDERS

HANNIFIN "CUSTOM" HYDRAULIC CYLINDERS

- Built in quantity for use on customers' products
- Specially designed for each application
- Often the most economical way to buy hydraulic cylinders

Bring us your cylinder problems.

HANNIFIN

Hannifin Corporation, 1109 S. Kilbourn Ave., Chicago 24, Ill.

Air and Hydraulic Cylinders • Hydraulic Power Units • Pneumatic and Hydraulic Presses • Air Control Valves

to the position of superintendent in that department. Mr. Simes joined the company in 1933.

D. E. INMAN has been appointed engineering manager of general industrial products by the Westinghouse Electric Corporation, Pittsburgh, Pa. Mr. Inman comes to his new assignment from the Chicago office, where he had been district engineering and service manager for the Northwestern District since 1949.

ROBERT E. KIMMINS has joined Firth Sterling, Inc., Pittsburgh, Pa., as assistant to the steel sales manager. In this capacity, he will take over the responsibilities of the company's high-temperature alloy steels.

CLECO DIVISION OF REED ROLLER BIT CO., Houston, Tex., recently appointed J. PEGELY AND SON HARDWARE CO., 6-12 S. York St., Pottstown, Pa., as distributor for Cleco products in that area.

THOMAS W. GABRIEL, general sales manager, has been appointed assistant vice-president in charge of sales for the Jessop Steel Co., Washington, Pa.

WESTINGHOUSE ELECTRIC CORPORATION recently began construction of a research center in Pittsburgh, Pa., which will ultimately replace the Westinghouse Research Laboratories. The new site is located only a few miles away from the present Laboratories.

EDWARD W. FORTH has been named assistant plant superintendent of DEWALT, INC., Lancaster, Pa., subsidiary of the American Machine & Foundry Co. Mr. Forth was quality manager of the AMF Buffalo Division at the time of his appointment.

CHARLES H. EVANS, superintendent, and PAUL H. MAGNUS, II, assistant superintendent, of the Rosedale Foundry & Machine Co., Pittsburgh, Pa., have recently been elected vice-presidents of the company.

CARL J. WESTLING, chief engineer, has been promoted to the post of director of engineering for Salem-Brosius, Inc., Pittsburgh, Pa., and will be in charge of the centralization of all engineering activities.

Tennessee, Mississippi, and Alabama

JONES & LAUGHLIN STEEL CORPORATION, Pittsburgh, Pa., has opened a warehouse at Nashville, Tenn. Resident manager will be LOUIS R. WEBB, who was sales representative for the concern in Nashville for the last six years.

DEAN WEIKART has been promoted to the position of chief engineer in the Tupelo, Miss., plant of the Rockwell Mfg. Co., Pittsburgh, Pa. Mr. Weikart was formerly tool and product engineer in the company's Crescent Machine Division at Leetonia, Ohio.

LESTER N. SHANNON, JR., has been appointed district manager by Firth Sterling, Inc., Pittsburgh, Pa. He will be in the southern district office located in Birmingham, Ala., replacing C. E. HUGHES, who has resigned.

Texas, Arizona, and Louisiana

CLECO DIVISION OF THE REED ROLLER BIT CO., Houston, Tex., announces the appointment of the following distributors for Cleco products: LA GRAND INDUSTRIAL SUPPLY CO., 15 S. W. Arthur St., Portland 1, Ore.; SIDNEY B. ROBY CO., 208-214 South Ave., Rochester, N. Y.; and FEHRS TRACTOR & EQUIPMENT CO., INC., 1809-11 Cuming St., Omaha 2, Nebr.

T. E. DONOHUE has been named sales manager in the Cleco Pneumatic Tool Division of the Reed Roller Bit Co., Houston, Tex., following the resignation of W. J. VOSSBRINCK. Mr. Donohue was formerly assistant sales manager.

KURT ORBAN CO., INC., New York City, has appointed the A. J. ROD CO., Houston, Tex., distributor of the company's line of German-made machine tools in Houston and southern Texas.

COLUMBIA TOOL STEEL CO., Chicago Heights, Ill., announces the appointment of the A. J. ROD CO., INC., as Texas sales representative. The Rod concern is located at 5011 Navigation Blvd., Houston, Tex.

NORDBERG MFG. CO., Milwaukee, Wis., announces the appointment of the SOUTHERN ENGINE & PUMP CO., Houston, Tex., as distributor for Nordberg 4FS Diesel engines in Texas and southern Louisiana.

NATIONAL SUPPLY CO., Pittsburgh, Pa., has acquired an 80-acre site for a plant in Gainesville, Tex.

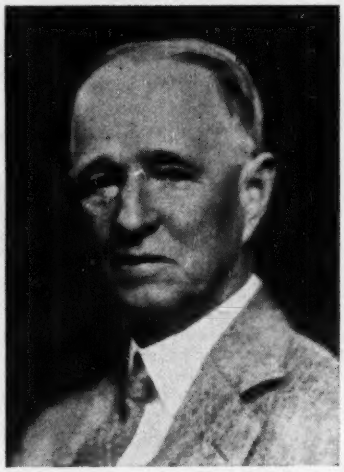
READY TOOL CO., Bridgeport, Conn., announces the appointment of the DI EUGENIO TOOL CENTER, 119 S. Eleventh Ave., Phoenix, Ariz., as sales engineers for Arizona, New Mexico, and Colorado.

QUAKER RUBBER CORPORATION, Philadelphia, Pa., Division of H. K. Porter Co., Inc., has established a warehouse and sales office at 2840 N. Claiborne St., New Orleans, La. The new branch is under the supervision of MORGAN KATHER.

Obituaries

Edward Payson Bullard, Jr.

Edward Payson Bullard, Jr., chairman emeritus of the board of directors of the Bullard Co., Bridgeport, Conn., died on June 26 at his home in Fairfield, Conn., at the age of eighty years. He was born in Columbus, Ohio. After graduation from



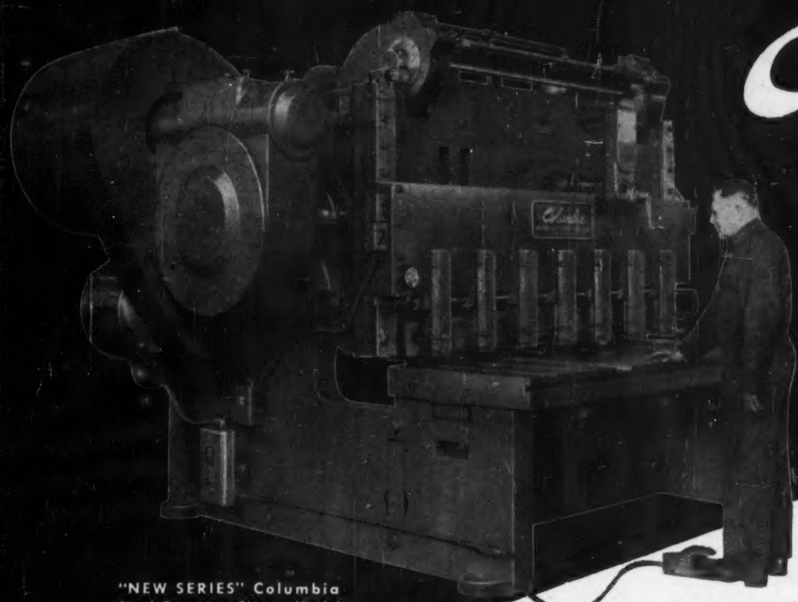
Edward Payson Bullard, Jr.

Amherst College, he began his sixty-year association with the Bullard Co. in 1892 as an apprentice machinist, then as a draftsman and later as assistant superintendent. At the turn of the century he went to Europe, where he represented the company for two years. Upon his return, he was appointed general manager of the plant, the position he held until 1907. In that year, Mr. Bullard was elected president of the company following the death of his father, who was the founder of the Bullard Co. He served as president for forty years.

Mr. Bullard received more than sixty patents for his developments, as well as national recognition of his work. In 1920, he was awarded the Howard N. Potts gold medal from the Franklin Institute of Pennsylvania for his development of the Mult-Au-Matic machine, and in 1927, a medal from the American Society of Mechanical Engineers for his leadership in the development of station type machine tools. Mr. Bullard also served as president of the National Machine Tool Builders' Association from 1911 to 1913. He retired from the presidency of the company in 1946, and at this time was elected chairman of the board of directors. Five years later he became chairman emeritus.

MAKE NO MISTAKE about it

Columbia builds BETTER shears!



"NEW SERIES" Columbia Steel Squaring Shear, Model 1206. Capacity: 6' x ¾".

"NEW SERIES" Columbia SHEARS are more convenient in operation, more accurate and safer; incorporate more stamina, have a greater production potential. Consider that fact; and its implied benefits of longer tool life, easier maintenance, fewer repairs, more production, less scrap, fewer accidents!

AS A QUICK EXAMPLE of Columbia's better design take a look at the Columbia exclusive air clutch.

- ★ It reduces gear wear by as much as 75% through elimination of gear movement except in actual cutting cycle.
- ★ Application of power is soft. Shocks are not transmitted.
- ★ Inherent clutch slippage at overload point acts as automatic cut-off.

AND THE DESIGN IS RICH with parallel advantages. Such as the exclusive hydraulic holddown finger connections which contribute so much to the ease of holddown system maintenance; the special slitting provision which extends the capacity of the bed; the blade clearance setting gage, which makes blade clearance setting an "operator function."

Other capacities from 6' x 3/16" to 6' x 1¼", 12' x 1", 14' x ¾", or 20' x ⅜" in mild steel.

DON'T FOLLOW BLIND PRECEDENT in the selection of your new shear. Don't risk the purchase of anything less than a modern Columbia tool. For the price is standard and delivery is often better.

FULL PARTICULARS WILL COST YOU only a minute of your time and the few cents required to mail your request. Don't delay! Even though your purchase of a shear may be a year or more away! Get the information now, and have it at hand when the need becomes urgent.

ASK FOR OUR FREE SHEAR CATALOG NO. 5315.
Address Columbia Machinery and Engineering Corporation, Hamilton 1, Ohio.

new series Columbia STEEL SQUARING SHEARS and POWER PRESS BRAKES

HAROLD E. RUSSELL, assistant sales manager of the Industrial Sales Division of A. Schrader's Son, Division of Scovill Mfg. Co., Inc., Brooklyn, N. Y., died on June 11. Mr. Russell joined the organization in a promotional capacity in 1937, and then became a representative for air control equipment. Later he was appointed assistant sales manager.

VICTOR W. PETERSON, chairman of the board of the Hannifin Corporation, Chicago, Ill., manufacturer of hydraulic and pneumatic equipment, died suddenly on July 1 at his Indiana farm, at the age of sixty-one years. Mr. Peterson, who resided at Evanston, Ill., was president and board chairman of the concern from 1928 to 1947, and retained the chairmanship until his death.

R. LESLIE BEATTIE, vice-president and general manager of Canadian operations of the International Nickel Co. of Canada Ltd., died suddenly in Toronto, Ont., at the age of sixty-two years. Mr. Beattie was born in Ontario. In 1911, he joined the Canadian Copper Co., a predecessor of International Nickel, and since that time had held various executive assignments in the company.

ROBERT F. HOLMES, sales manager of the Universal Engineering Sales Co., sales agents for the Universal Engineering Co., Frankenmuth, Mich., died suddenly on May 26 of coronary thrombosis while on a sales trip to Kenosha, Wis., at the age of forty-nine years. Mr. Holmes was associated with the company for seven years.

MATTHEW J. SCAMMELL, president of S. L. Allen & Co., Inc., Philadelphia, Pa., tractor manufacturer, died at his home in Trenton, N. J., on June 15. Mr. Scammell was president of the organization since 1929. He was active in the American Iron and Steel Institute and the Metal Manufacturers Association of Philadelphia.

New Books and Publications

PIPEFITTERS HANDBOOK. By Forrest R. Lindsey. 282 pages, 4 by 7 inches. Published by The Industrial Press, 148 Lafayette St., New York 13, N. Y. Price, $6.

This handbook, written by a pipefitter with thirty-five years' experience, is intended to enable the fitter to solve problems in the shop or field in connection with pipe bending, offsetting, mitering, and lay-out, for example. The first section contains worked out figures for setback and length of bend for a very wide range of angles and radii, giving, in addition, basic formulas. Then data on offset bends; laying out of mitered joints; dimensions of steel and wrought iron pipe, copper tube, pipe threads, and screwed fittings; laying length of butt welding and flanged fittings, and valves; and dimensions of solder joint fittings are presented.

Other pipe and miscellaneous data include dimensions of U-bolts for pipe hangers; instructions on pipe threading, soldering, and brazing; table of minimum radii for pipe bends; weight and volume of water per foot for various pipe sizes; spacing of pipe hangers; spacing of holes in gaskets or flanges; sheet-metal gages; weights and melting points of metals; tables on properties of steam; and laying out angles with a 6-foot rule. Mathematical data consist of circumferences and areas of of circles, squares, and square roots of numbers; areas and volumes of plane and solid shapes; reciprocals of numbers; weights and measures; and conversion factors. Also, a section is included on the use of trigonometry. A glossary of terms used in pipefitting concludes the book.

ASTM STANDARDS ON COPPER AND COPPER ALLOYS. 540 pages, 6 by 9 inches. Published by the American Society for Testing Materials, 1916 Race St., Philadelphia 3, Pa. Price $5 (paper bound); $5.65 (cloth bound).

All of the ASTM Standards pertaining to copper and copper alloys (which were developed by technical committees of the Society) are brought together in this 1953 edition. Standards cover copper, copper alloy, and copper covered steel electrical conductors; non-ferrous metals; plate, sheet, strip, and rolled bar; rod, bar, and shapes; wire; pipe and tube; ingot; sand and die castings; filler metal; and methods of testing copper and copper alloys. A group of specifications covers non-ferrous metals such as slab zinc, pig lead, nickel, phosphor, silicon, and electrolytic cathode copper. Also included are test methods covering expansion, mercurous nitrate, resistivity, preparation of micrographs, tension, hardness, sampling, and grain size evaluation.

INDUSTRIAL DIRECTORY OF NEW YORK STATE (1953). 1012 pages, 8 3/4 by 11 1/4 inches. Published by the New York State Department of Commerce, 112 State St., Albany, N. Y. Price, $25.

Information on nearly 50,000 New York State manufacturing and mining firms is contained in this directory arranged alphabetically, and by industry, and by geographical location. More than 7000 products made in the State are covered in this buyers' guide. In addition to the name and address of firms, it gives the names and titles of executives, lists of products, and employment figures where this information was reported. New York City concerns are listed separately in the industrial section. Helpful cross-references are given.

MATERIALS OF ENGINEERING (Eighth Edition). By Herbert F. Moore and Mark B. Moore. 372 pages, 6 by 9 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 36, N. Y. Price, $6.

This revised edition of a volume that deals with the properties of various materials used for machine and structural parts offers recent information given by the electron microscope, presents a discussion of resistance to fatigue by metals that are under compressive loads, discusses boron and titanium, and uses the nomenclature for fatigue of metals which has been recommended by the American Society for Testing Materials. The book is especially suitable for classroom work.

Coming Events

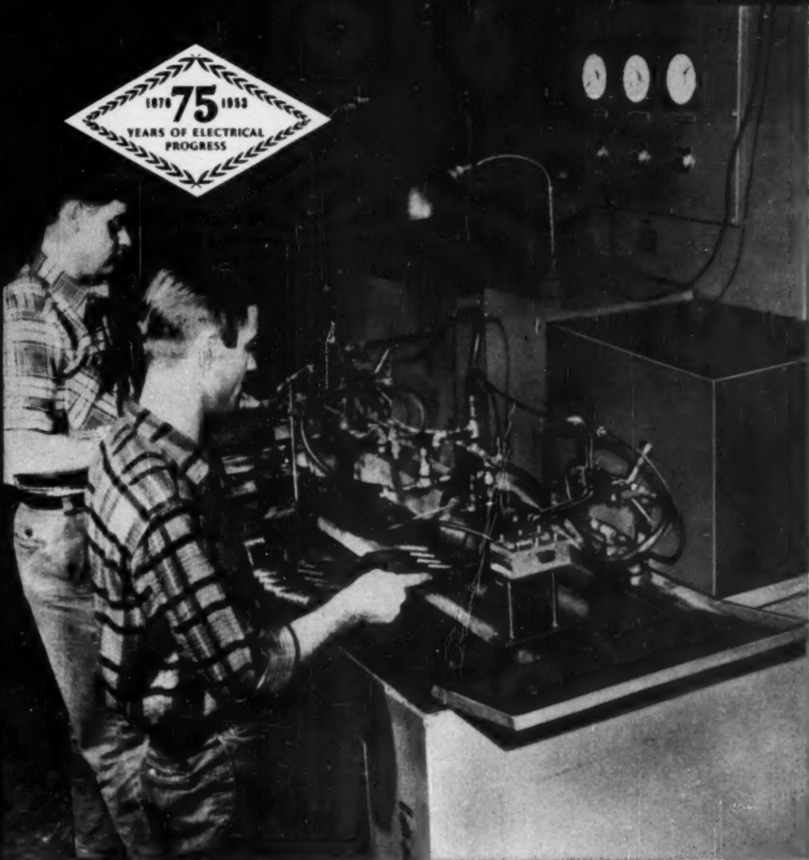
SEPTEMBER 4-13—THIRD EUROPEAN MACHINE TOOL EXPOSITION in Brussels, Belgium, sponsored by the Belgium Society of Machine Tools for Metal-Working. Further information can be obtained from the general manager of the Exposition, Pol Raskin, 21, rue des Drapiers, Brussels, Belgium.

SEPTEMBER 21-25—Exposition of the INSTRUMENT SOCIETY OF AMERICA, at the Sherman Hotel, Chicago, Ill. Further information can be obtained from the Society, 1319 Allegheny Ave., Pittsburgh, Pa.

OCTOBER 5-7—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Sheraton, Rochester, N. Y. Secretary, C. E. Davies, 29 W. 39th St., New York 18, N. Y.

OCTOBER 19-23—Thirty-fifth National Metal Exposition and Congress of the AMERICAN SOCIETY FOR METALS to be held at the Cleveland Public Auditorium, Cleveland, Ohio. Secretary, W. H. Eisenman, 7301 Euclid Ave., Cleveland 3, Ohio.

OCTOBER 25-28—Semi-annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION, to be held at Edgewater Beach Hotel, Chicago, Ill. John C. Sears, executive secretary, Empire Bldg., Pittsburg 22, Pa.



INDUCTION HARDENING RACK BARS AT BURROUGHS CORPORATION.

Hardening Costs Cut 65 Percent With G-E Induction Heaters

"By changing to induction heat, we have reduced rack-bar hardening costs as much as 65%," reports Stanley Bankett, Jr., heat-treating foreman at the Plymouth Plant of the Burroughs Corp., Detroit, Mich.

When using old heat-treating methods for hardening parts, Burroughs was faced with expensive straightening operations to eliminate distortion. Now, by applying selective induction heat with G-E heaters, Burroughs heat-treats only the areas that require hardening—thus preserving the original shape of the bar while maintaining top quality.

Improved working conditions are another benefit now enjoyed by Burroughs, because compact G-E heaters eliminate the discomfort of radiant heat and provide cleaner, more comfortable working areas.

Burroughs has added six G-E heaters since first adopting induction heat. Today, they use induction heat for a variety of heat-treating operations involving many business-machine parts. In each case, substantial savings have resulted.

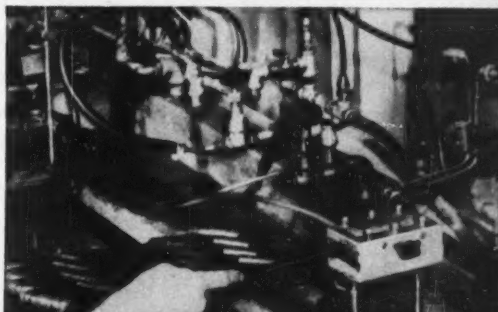
This high-quality selective heating at lower cost is available to you. To learn how you can profitably apply G-E induction heat to your operations, contact your G-E Apparatus Sales representative. And write now for bulletins on G-E induction heaters to General Electric Co., Sect. 720-108, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

SELECTIVE HARDENING occurs at darkened areas which must resist excessive wear. Maximum hardness is obtained without distorting bar.

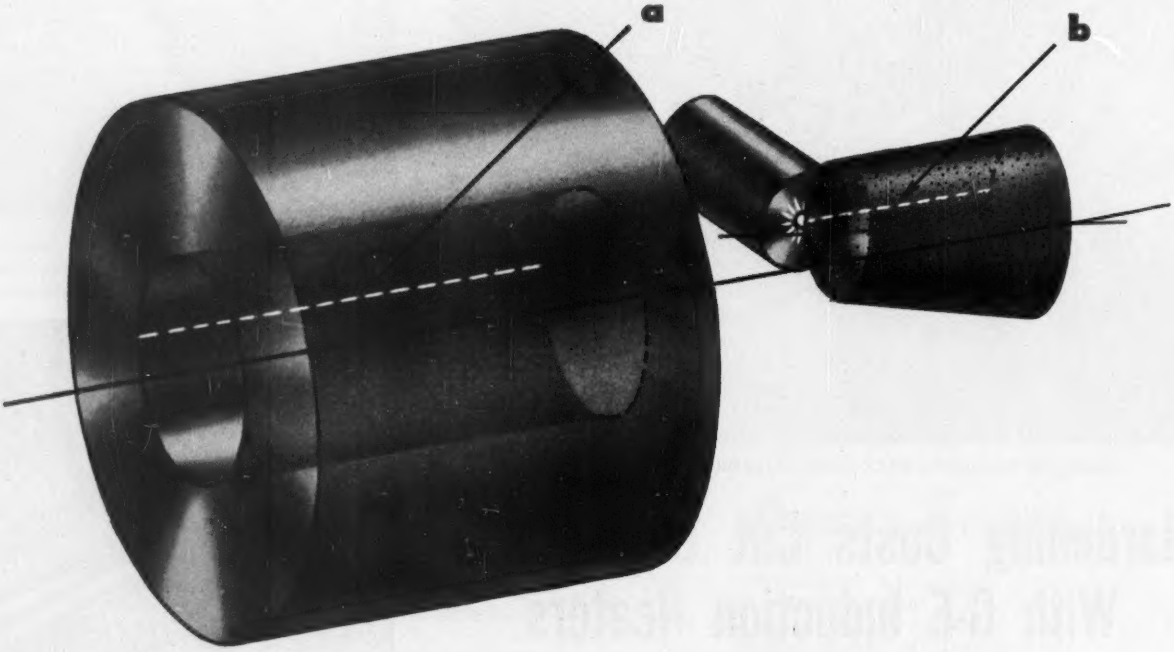
ACCURATE HEAT CONTROL in the simple induction fixtures shown above and below assures uniform hardness of every bar.



HIGH-SPEED PRODUCTION is typical of G-E induction heating. Over 1500 parts are heat-treated daily in this versatile G-E 15-kw unit.

alignment

for better internal grinding



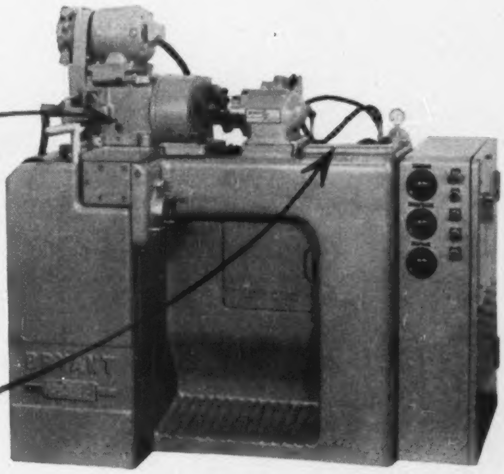
GRINDING a straight hole on an internal grinder is normally done with a straight (cylindrical) wheel. It is sometimes desirable to turn the wheelhead and dress the wheel to a taper in order to use a more rigid projection. However, this setup presents some serious obstacles which cannot be overcome unless they are clearly understood. In order to grind a straight hole the various elements of the machine must be in perfect alignment. The degree of alignment will be determined by the accuracy required on the finished part. A machine may be lined up sufficiently to produce holes within tolerance when grinding with a straight wheel, but if the wheel is turned and dressed to a taper, the alignment problem is magnified to such an extent that it may be impossible to produce holes within the same tolerance.

The center lines of the wheel, work and diamond must be in a common plane so that the wheel contacts the work at line "a". If the tapered wheel contacts the work above or below line "a" the wheel will touch only at its

largest diameter and, as the wheel reverses (at the left end of the hole), it will transfer its taper to the work resulting in a tight hole at the back. Turning the workhead or changing the length of traverse cannot overcome this error. Further, because of poor contact, wheel wear will be excessive and finish poor.

If the diamond is set either above or below line "b" (which is a continuation of "a") the wheel will be dressed to a curve (hyperbola) and even if the wheel contacts the work at line "a" it will be only a point contact. Again, the wheel form will be transferred to the work at the point of reversal, wheel wear will be excessive and finish poor. The proper setup calls for the work axis, wheel axis and diamond to be in a plane parallel to the longitudinal and cross motion of the machine.

Left end of workhead may be raised or lowered to bring its axis into a plane parallel with wheelslide bar.



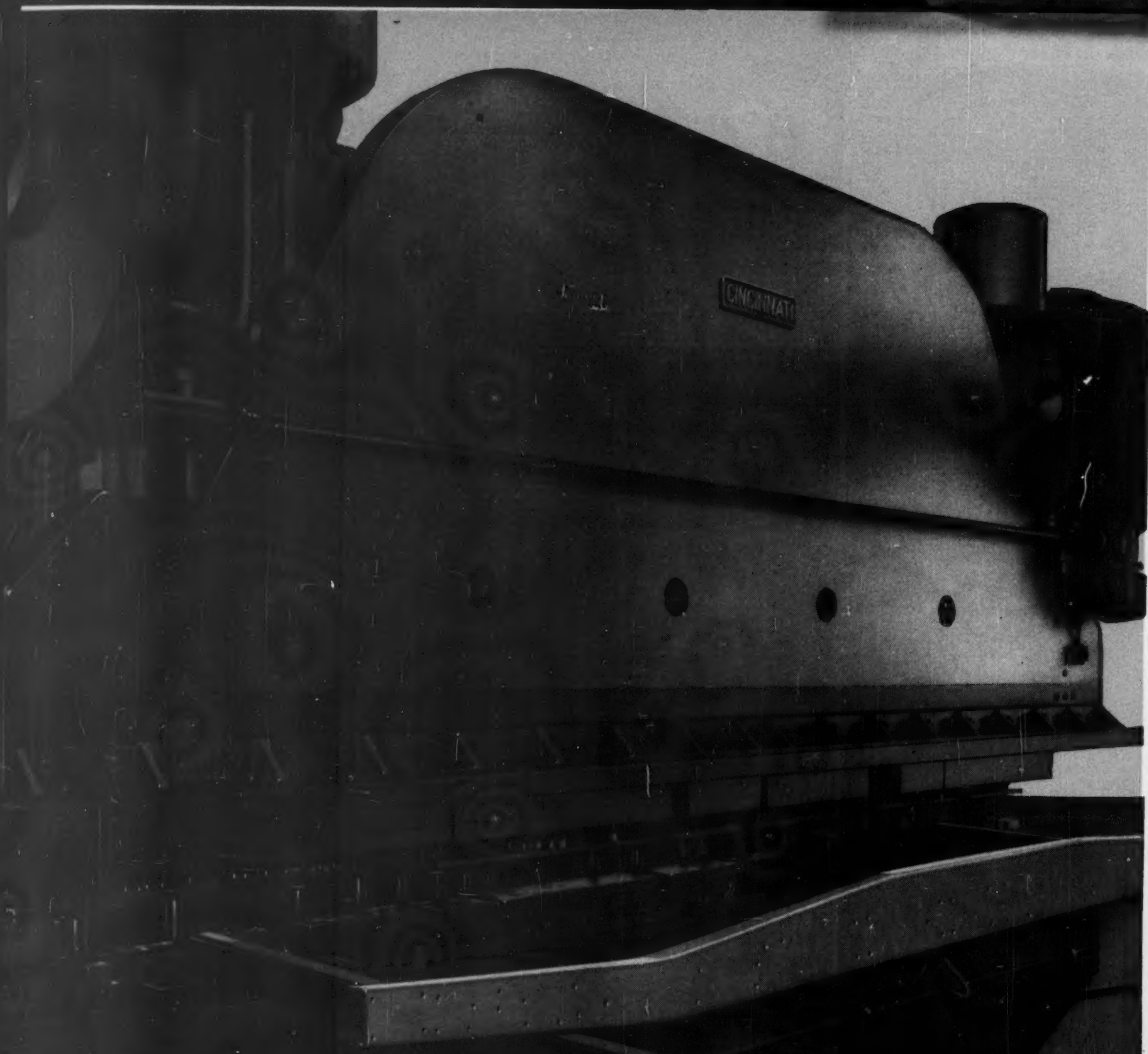
Rear of wheelslide may be adjusted to insure straight line motion of the wheel.

The Bryant 1109 Precision Internal Grinder is a semiautomatic machine, designed especially for grinding small bores. Although intended primarily for bore diameters of less than 1", it has a chuck swing of 9" and a maximum grinding stroke of 3½". By using preloaded bar slides for both cross and longitudinal slide movements, sensitivity is obtained without loss of rigidity. These rigid slides transmit the operating load directly to the base of the machine. The Bryant Hi-Frequency Wheelhead, providing speeds up to 100,000 R.P.M., is furnished as standard equipment to assure efficient surface speeds on the wheels necessary for griding small bores. Write for further information.

Bryant Chucking Grinder Company

Springfield, Vermont, U. S. A.

Internal grinders • Internal & External thread gages



Material: 3/16" mild steel.
Maximum number of holes: 104.
Maximum diameter of hole: 1-3/16".

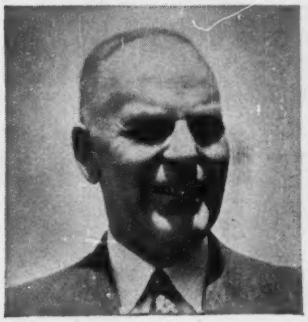
Stops tarnish on copper alloy jobs . . .

● Sciaky Brothers Inc., Chicago manufacturers of spot welding equipment, were having trouble obtaining a suitable finish on certain copper alloy parts. After they were machined, parts frequently had to be processed to remove stain or tarnish. This took time and labor and cut down production.

Upon the advice of a Standard Oil cutting oil specialist, officials of this company put a STANICUT Cutting Oil to work on the troublesome copper alloy machining jobs. It was the end for tarnish troubles. On a wide variety of operations employing many different copper alloys, STANICUT has provided both superior finish and excellent tool life. Of further importance to this company, STANICUT has been used with success on other jobs and, today, is employed for all operations requiring a cutting oil. This has eliminated the cost and trouble of stocking and using several different cutting oils.

To help you get better cutting oil results, Standard Oil has a metalworking service that is unique in the Midwest. It gives you the metalworking products, the engineering service, and the supply service that fit your special operation and needs. The cutting oil specialist serving in your section of the Midwest will be glad to tell you more about this personalized service. You can reach this man easily by phoning your local Standard Oil office.

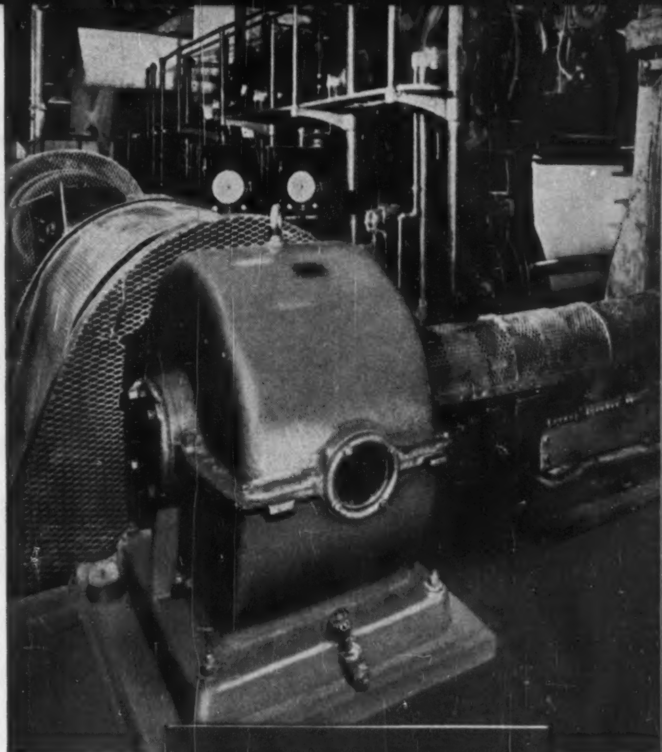
What's YOUR problem?



A. L. Seabaugh, who makes his headquarters at Standard's Chicago office, is the cutting oil specialist who recommended STANICUT Cutting Oil to operators of this midwest company and helped them solve a tarnish problem. Moreover, he has followed through on this problem to help his customer make additional cutting oil savings.

A. L. Seabaugh is one of a corps of able lubrication specialists who have headquarters in Standard offices throughout the Midwest. These men have been specially trained in Standard Oil Lubrication Engineering Schools and, in addition, have a wealth of practical experience. The specialist nearest your plant will work closely with you, giving you the help you need when you need it, to produce better cutting oil results.

You'll discover how easily and quickly you can obtain the services of this lubrication specialist by phoning your local Standard Oil office.



NEW STANOGEAR Compounds

REG. U. S. PAT. OFF.

7 ways better for extreme-pressure lubricating jobs!

New and improved STANOGEAR Compounds have been developed to meet the requirements of the tougher extreme-pressure lubricating jobs found throughout industry, today. These outstanding products have proved their ability to provide these important advantages:

1. Higher load carrying capacity.
2. Superior retention of load carrying capacity.
3. Freedom from objectionable deposits.
4. Excellent storage stability.
5. Good water separation.
6. Anti-foaming.
7. Versatility.

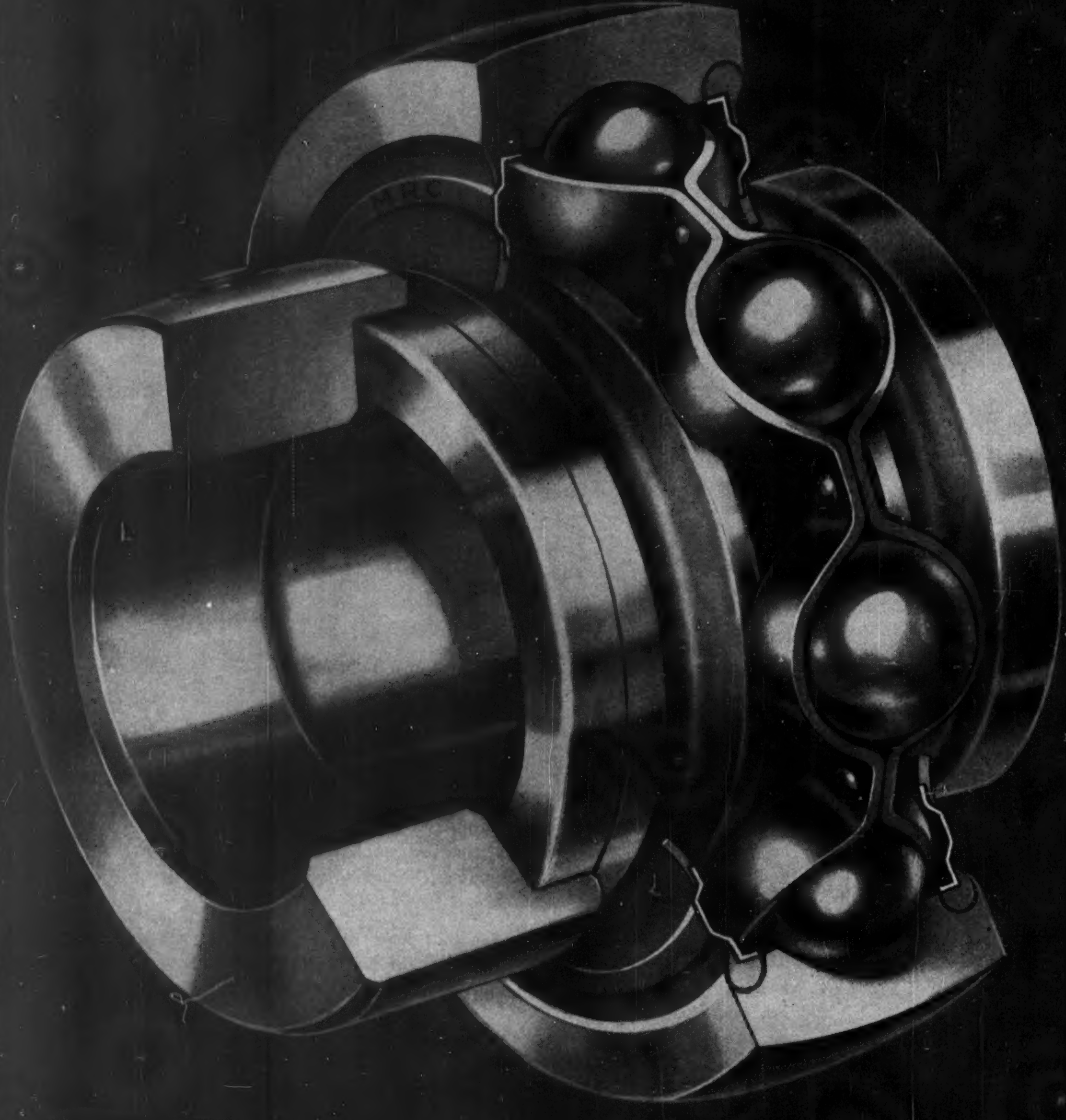
The Standard lubrication specialist in your area of the Midwest can give you more information about the new STANOGEAR Compounds and help you apply them more effectively. Phone your local Standard Oil office. Or, write, Standard Oil Company, 910 S. Michigan Ave., Chicago 80, Illinois.

STANDARD

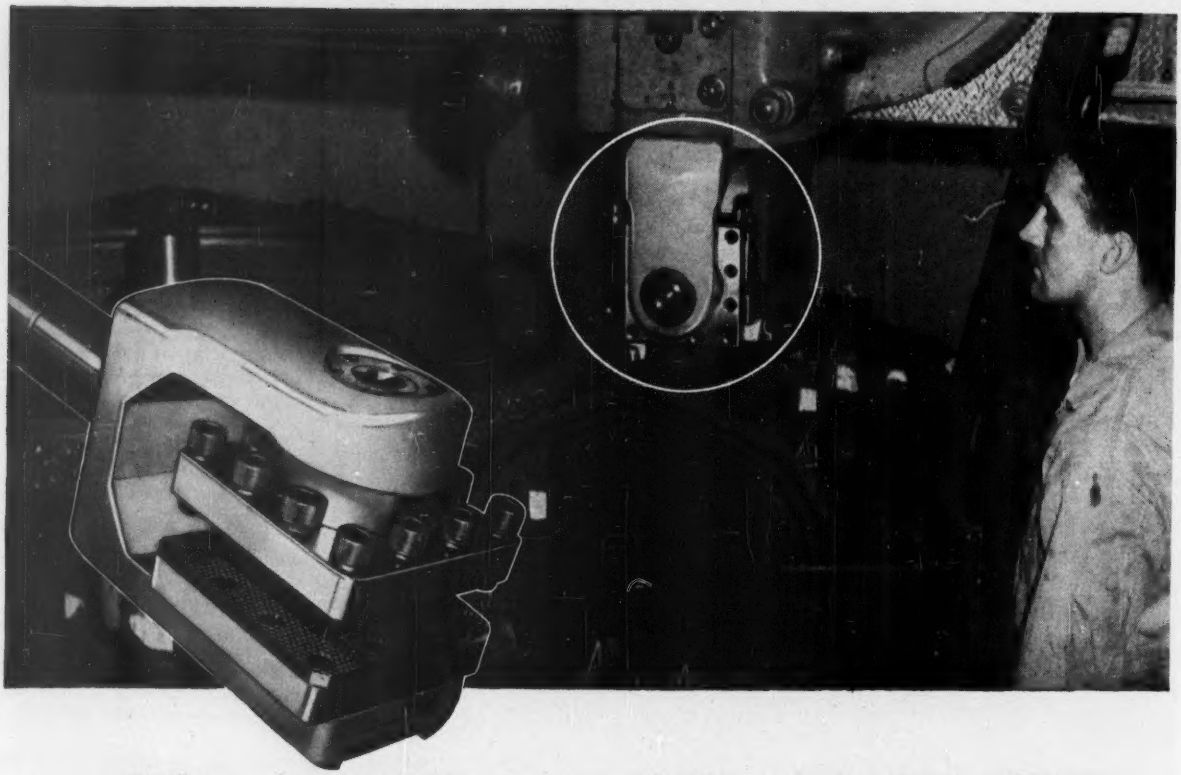
STANDARD OIL COMPANY

(INDIANA)


Better
bearings
make
them
better
buys!
HYATT MADE IN


M R C

Perform *four* operations from a *single* setup...

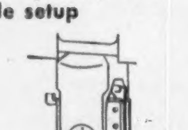


—with a DAVIS 8-position tool holder

speeds work, reduces setup costs on vertical boring and turning mills

Typical series of operations on a single setup

8-Position Tool Holder used in facing operation



Tool indexed 90° for undercutting operation

Tool indexed 90° to present turning tool

Tool indexed 45° for chamfering

NOW, save more setup time than ever before possible! With this new Davis Tool Holder you can turn, undercut, bore and chamfer in one setup. You can mount four tools at once.

One simple wrench adjustment will change your position through 360° in accurately indexed increments of 45°. Two index pins and a center pin locate and clamp the complete assembly in rigid alignment. Heavy cast steel body assures accuracy.

Increase your production with your present equipment . . . solve the age-old problem of too numerous setups, too many tool changes. For details on the Davis 8-Position Tool Holder, see your representative or write direct.

If Davis can't bore it, it can't be done!

DAVIS BORING TOOL DIVISION

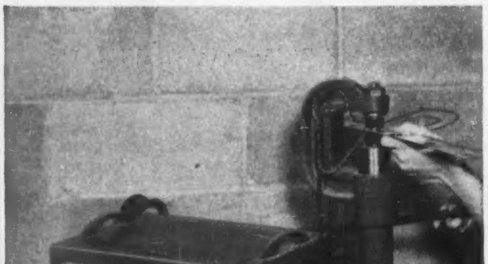
GIDDINGS & LEWIS MACHINE TOOL CO., FOND DU LAC, WISCONSIN

Builders of plain and micrometer adjustable block type boring tools; line boring bars; special boring tools; car wheel boring tools; planer, vertical boring and turning mill tools; Quick Change arbors and sleeves.

EASY OPERATION OF INDICATOR PERMITS PARTS FOR 12-HOUR PRODUCTION TO BE CHECKED IN 15 MINUTES

Fast testing for better aluminum welds

Guesswork taken out of welding preparation by G-E Surface Resistance Indicator



ON PRODUCTION TESTING, operation requires no technical knowledge and is completed in seconds.

Spotweld Co., of Cleveland, Ohio uses a General Electric Surface Resistance Indicator in the preparation of aluminum parts for welding. Fabricating parts for aircraft, refrigerator units, tie rails, and vending machines, the company carefully checks surfaces to be welded after degreasing and deoxidization.

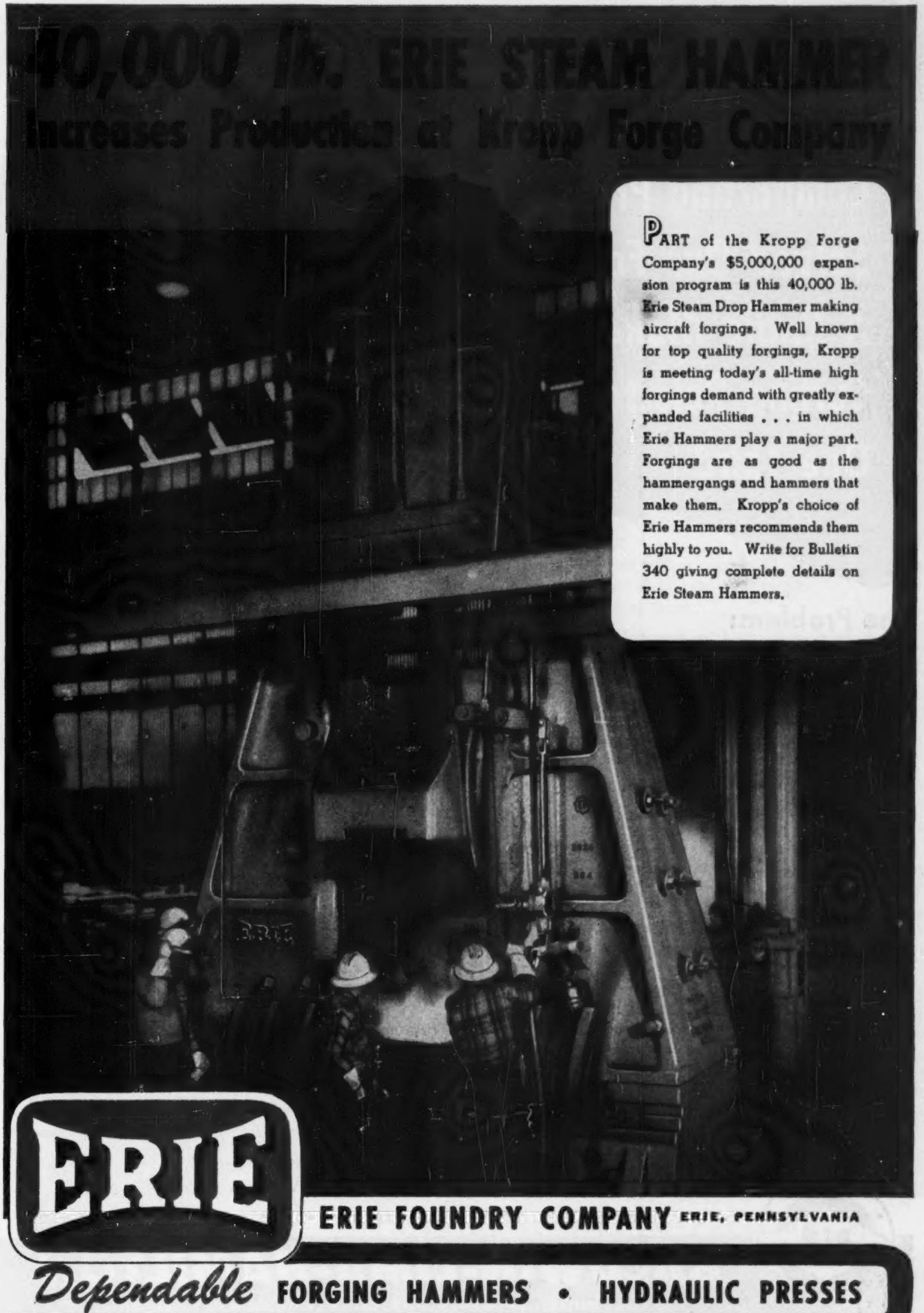
"Our G-E indicator has taken the guesswork out of preparation of aluminum for good welding," the company reports. In addition, all parts to be welded can be checked in fifteen minutes for a twelve-hour production period.

Surface resistance of aluminum is important in condition of the weld nugget. If cleaning and deoxidizing solutions become contaminated, metal is not thoroughly prepared—and good welds cannot be obtained. Large changes in resistance will result from relatively small changes in concentration or contamination of solutions.

Electrode pickup, inconsistency of welds and metal expulsion can be greatly reduced by use of the indicator. Further information can be obtained from your nearest G-E Apparatus Sales Office, or write for Bulletin GEA-5823 to General Electric Co., Section 687-121, Schenectady 5, N. Y.

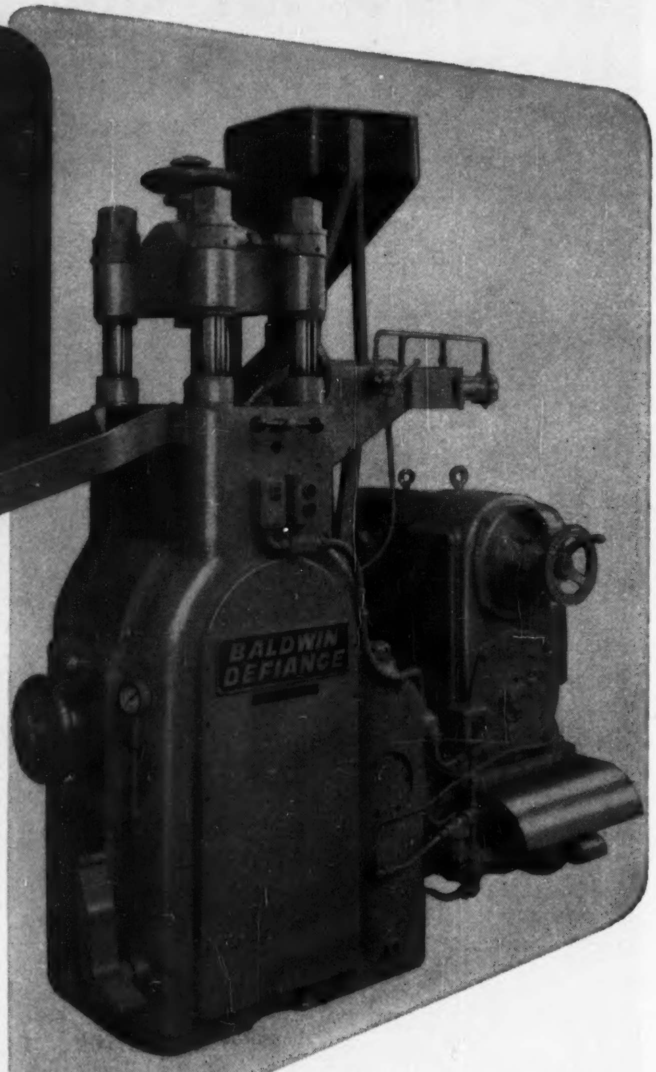
You can put your confidence in—

GENERAL ELECTRIC


40,000 lb. ERIE STEAM HAMMER
Increases Production at Kropp Forge Company
PART of the Kropp Forge Company's $5,000,000 expansion program is this 40,000 lb. Erie Steam Drop Hammer making aircraft forgings. Well known for top quality forgings, Kropp is meeting today's all-time high forgings demand with greatly expanded facilities . . . in which Erie Hammers play a major part. Forgings are as good as the hammergangs and hammers that make them. Kropp's choice of Erie Hammers recommends them highly to you. Write for Bulletin 340 giving complete details on Erie Steam Hammers.
ERIE
ERIE FOUNDRY COMPANY ERIE, PENNSYLVANIA
Dependable FORGING HAMMERS • HYDRAULIC PRESSES

WHAT'S YOUR PRESSING PROBLEM?

A BALDWIN Compacting Press *Solved One For A Radio Maker,* Cutting Rejects One Third



Baldwin Model 20 Compacting Press, for pressures up to 75 tons, which is being used to compact powdered metal into "radio cores" for pushbutton radios.

The Problem:

A major radio manufacturer was having trouble achieving uniform density in radio cores . . . the $\frac{3}{16}$" by $1\frac{1}{2}$" metal cylinders on the end of each push button. Uniformity from core to core and from end to end in each core was necessary in order to maintain certain electrical characteristics.

The Baldwin Solution:

Tests by Baldwin revealed that with radio cores made on a Baldwin standard Model 20 press, there were roughly one-third less rejects than when the product was made on a different type press for compacting powdered metal.

This radio manufacturer designed and built a carboloy die to fit this Baldwin Press. Further savings are anticipated because the life of this die will be greatly prolonged by the positive alignment of the punch and die. In the Baldwin press the punch is mounted on a rigid four-column guided head with the guides completely enclosed and sealed.

This direct up and down motion and a most efficient feeder are the features of the Model 20 press which account for the greater uniformity of the radio cores produced on it. The feeder is the reciprocating type that moves in and out over the die with a very smooth motion, distributing the powder in the die more evenly. Also, Baldwin has designed this feeder with no recess or protrusion to trap the powdered metal and prevent it from flowing readily into the die cavity.

The Baldwin Research and Development Laboratory is ready to help you solve your pressing problem . . . write Dept. 4119, Baldwin-Lima-Hamilton Corporation, Philadelphia 42, Pa.

BALDWIN BLH LIMA-HAMILTON

BALDWIN-LIMA-HAMILTON

General Offices: Philadelphia 42, Pa. • Offices in Principal Cities

Chosen over other methods, the Microhoning process is being used to generate the inside surface of the new 280 mm atomic gun barrel!

Microhoning . . . corrects all inaccuracies left by previous operations and generates a round, straight bore . . . eliminates several processing operations formerly required to obtain the necessary accuracy . . . facilitates broaching of the rifling by providing a true piloting diameter . . . assures a superior seal between the barrel and the projectile.

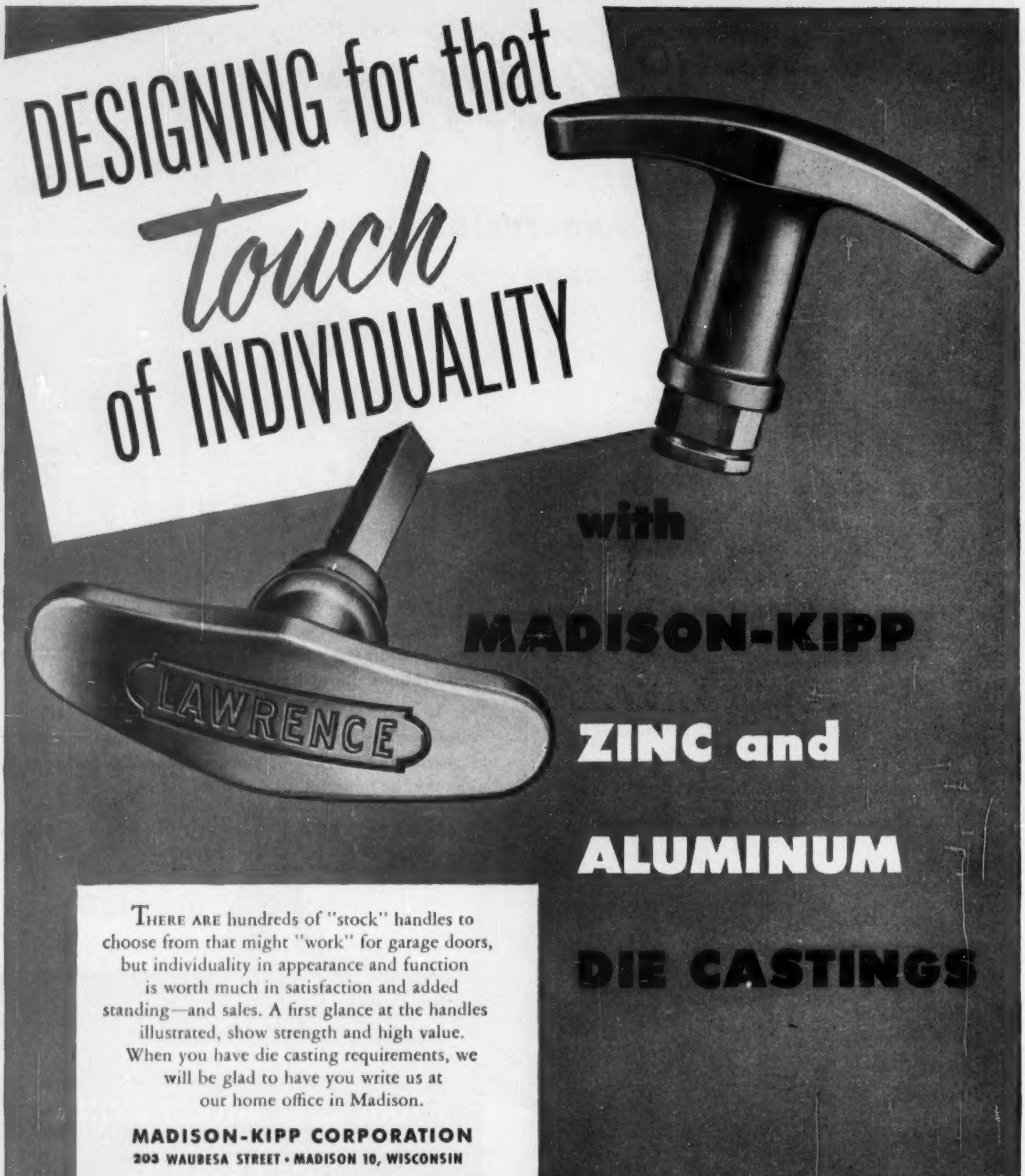
Constant improvement in this application has produced a Microhoning tool with a gage built into its nose, simplifying diameter checking and cutting 4/5 off the former Microhoning time!

This is another example of how Micromatic is continually developing new and better equipment for Microhoning all types of surfaces regardless of length, diameter, or material.

MICROHONING = STOCK REMOVAL + GEOMETRY + SIZE CONTROL + SURFACE FINISH

MICROMATIC HONE CORPORATION
8100 Schoolcraft, Detroit 4, Michigan

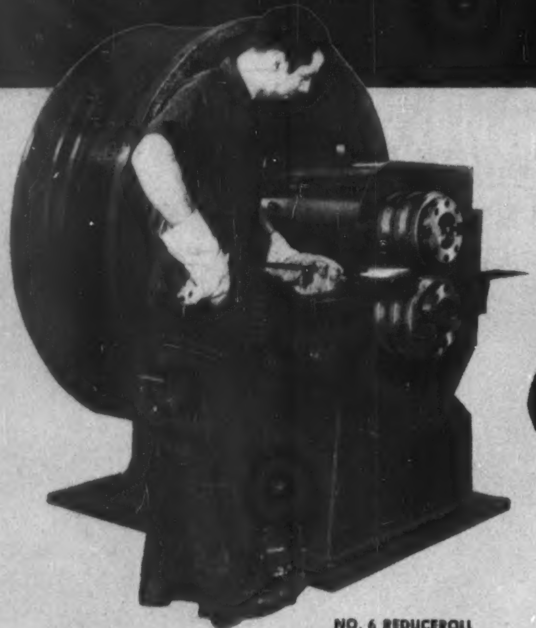
MICROMATIC HONE CORP. MICRO-MOLD MFG. DIV. Boston Post Road Guilford, Connecticut	MICROMATIC HONE CORP. 614 Empire Building 206 So. Main Street Rockford, Illinois	MICROMATIC HONE CORP. 1535 Grande Vista Avenue Los Angeles 23, California	MICROMATIC HONE LTD. 330 Grand River Avenue Brantford, Ontario, Canada	MICROMATIC HONE CORP. MICRO-MOLD MFG. DIV. 231 So. Pendleton Avenue Pendleton, Indiana



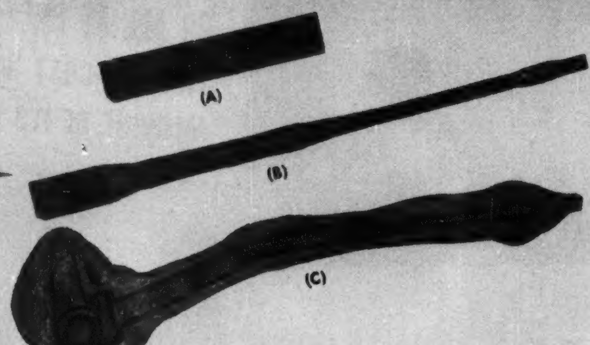
DESIGNING for that
touch
of INDIVIDUALITY
LAWRENCE
with
MADISON-KIPP
ZINC and
ALUMINUM
DIE CASTINGS
THERE ARE hundreds of "stock" handles to choose from that might "work" for garage doors, but individuality in appearance and function is worth much in satisfaction and added standing—and sales. A first glance at the handles illustrated, show strength and high value. When you have die casting requirements, we will be glad to have you write us at our home office in Madison.
MADISON-KIPP CORPORATION
203 WAUBESA STREET • MADISON 10, WISCONSIN
kipp
• Skilled in Die Casting Mechanics • Experienced in Lubrication Engineering • Originators of Really High Speed Air Tools

SAVED BY REDUCEROLLING . . .

ONE MAN . . .
ONE HEAT . . .
ONE POUND of STEEL
per FORGING!



NO. 6 REDUCEROLL



REDUCEROLLING
gives these advantages:

1. Increases production
2. Does not require skilled labor
3. Increases forging die life
4. Saves expensive material
5. Low-cost, quickly interchangeable rolls

At Canada Foundries and Forgings Ltd., Welland, Ontario, the clutch pedal forging illustrated above, was *formerly* forged as follows: Stock was heated and upset in a 3" upsetter, then reheated and finish-forged in a 2500 lb. hammer. These operations required a crew of five men.

Now, by substituting a No. 6 REDUCEROLL for the upsetter, the blank is REDUCEROLLED and finish-forged on the same heat. This method requires only four men, and it saves one pound of steel per forging!

Stock (A) measures 1½ inches square by 9¾ inches long, weighs 6.24 lbs. REDUCEROLLED blank (B) ready for forging. Finished forging (C) forged on the original heat. Note small amount of flash.

NATIONAL MACHINERY COMPANY
TIFFIN, OHIO—SINCE 1874

DESIGNERS AND BUILDERS OF MODERN FORGING MACHINES • MAXIPRESSES • REDUCEROLLS • COLD HEADERS • BOLTMAKERS • NUT FORMERS • TAPPERS • NAILMAKERS

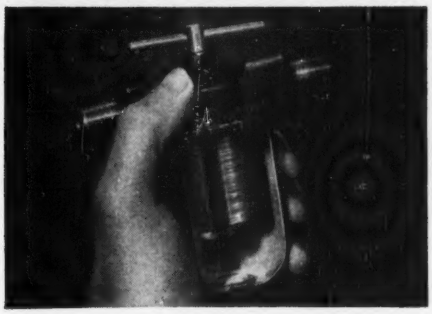
Hartford Detroit Chicago

Here's how this strainer "combs" itself clean!

This simple chalk test shows how AUTO-KLEAN's unique built-in comb construction cleans the strainer without costly interruption of flow

ORDINARY BLACKBOARD CHALK leaves heavy deposit of chalk particles on and between discs of Cuno AUTO-KLEAN strainer.

TURNING HANDLE ONE REVOLUTION moves strainer element through comb blades, removing all traces of chalk from between discs. Cuno's exclusive combing operation cleans *thoroughly* —without stopping flow.



FILTERING AREA IS COMPLETELY CLEAN, restoring full initial capacity. All chalk particles and dirt fall to bottom of housing where they can be drained periodically.

- AUTO-KLEAN's permanent metal filter element is available in steel, brass, or stainless steel for long, trouble-free service.
- AUTO-KLEAN is adaptable to any fluid-flow system.
- From acids to tar . . . if you can pump it, Cuno can filter it. Capacities range from one gallon per hour to 15,000 gallons per minute.

CUNO

ENGINEERED FILTRATION

Removes More Sizes of Solids From More Kinds of Fluids

AUTO-KLEAN (disc-type) • MICRO-KLEAN (fibre cartridge) • FLO-KLEAN (wire-wound)

SINGLE-STRAINER PROTECTION FOR LUBE OILS AND PROCESS FLUIDS

Continuously cleanable AUTO-KLEAN eliminates need for stand-by strainers

AUTO-KLEAN's compact construction gives you full-flow operation in space which would limit ordinary filters to by-pass service. The low pressure drop of AUTO-KLEAN strainers permits this *full-flow* service on gravity, low pressure, high pressure, or suction lines—with no loss in operating efficiency.

Cuno's exclusive "comb-clean" action provides complete cleaning of the filter element—without stopping fluid flow. Thus, there's no need for a stand-by strainer.

The low maintenance costs of the AUTO-KLEAN save you money, for there are no cartridges to change. An occasional rotation of the handle does the cleaning job (most units can be equipped with motor-drives for continuous cleaning).

Fixed-space metal discs in this modern strainer positively remove all solids larger than the specified disc spacing—from .0035" up to .062".

For permanent, positive fluid protection, install compact Cuno AUTO-KLEAN—the precision-built strainer. Send the coupon for free bulletin.

A.3.3

Cuno Engineering Corporation
Dept. 133A, South Vine Street, Meriden, Conn.
Please send me bulletin on Cuno AUTO-KLEAN

for .... (fluid)

Name..............................

Company...........................

Address...........................

City.............. Zone.... State........


SALES
DEPT.

Select the right W&B drill

for Enlarging Holes in Metals

Frequently it is necessary to enlarge holes in castings, steel forgings or punched metals. Hercules High Speed Three and Four Flute Core Drills are specifically designed and heat treated to proper hardness for efficiently enlarging cored, drilled or punched holes. Taper shank core drills are available in diameters from ¼" to 3" and straight shank core drills from ¼" to 2" diameters.

Just off the presses is a new catalog covering the complete W & B line of Drills, Reamers, Countersinks, Counterbores, Carbide Tools, Tool Bits and Special Tools. Write today on your letterhead for your free copy of this attractive and extremely usable tool catalog.

W&B

DRILLS
REAMERS
COUNTERBORES
COUNTERSINKS
CARBIDE TOOLS
TOOL BITS
SPECIAL TOOLS

Contact Your Local W & B Distributor

"Makers of Fine Tools Since 1848"

WHITMAN & BARNES

PLYMOUTH, MICHIGAN

NEW YORK • CHICAGO • LOS ANGELES • HOUSTON

Product Directory

To find headings easily, look for capital lettters at top of each page to denote locations.

ABRASIVE CLOTH, Paper and Belt
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

ABRASIVE DISCS
See Discs, Abrasive

ABRASIVES, HONING
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.

ABRASIVES, Polishing, Tumbling, Etc.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Cratex Mfg. Co., 81 Natoma St., San Francisco 5, Cal.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.

ACCUMULATORS, Hydraulic
American Steel Foundries, Elmes Engineering Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

AIR HOISTS—See Hoists, Air.

AIR TOOLS—See Grinders, Pneumatic; Drills, Portable Pneumatic, Etc.

ALLOY STEELS
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York 1, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., Carnegie-Illinois Steel Corp. Div., 436 7th Ave., Pittsburgh, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

ALLOY STEELS, High Temperature
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.

ALLOYS, Aluminum
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

ALLOYS, Magnesium
Dow Chemical Co., Midland, Mich.

ALLOYS, Non-Ferrous
American Brass Co., 25 Broadway, New York.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

ARBOR PRESSES
See Presses, Arbor

ARBORS AND MANDRELS
Beaver Tool & Engineering Corp. (Arbors, only), 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

BABBITT
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Ryerson, Jos. T., & Son, 2558 W. 16th St., Chicago 18, Ill.

(Continued on page 292)

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   H. M. Richardson & Co., 9 East 22nd Street
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Keller Tool Co., Grand Haven, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pope Machinery Corp., Haverhill, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

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Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Kennametal, Inc., Latrobe, Pa.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

BARS, Phospher Bronze

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BARS, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., (Cold Drawn), Republic Bldg., Cleveland, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock, Lovejoy & Co., Inc., Cambridge, Mass.

BASES, Machinery Welded

Mahon, R. C., Co., 6565 E. 8 Mile Rd., Detroit 34, Mich.

BEARINGS, Babbitt

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Ball

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Torrington Co., Torrington, Conn.

BEARINGS, Bronze and Special Alloy

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Johnson Bronze Co., New Castle, Pa.
Link-Belt Co., 2410 W. 18th St., Chicago 8, Ill.

BEARINGS, Lineshaft

Fafnir Bearing Co., New Britain, Conn.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.

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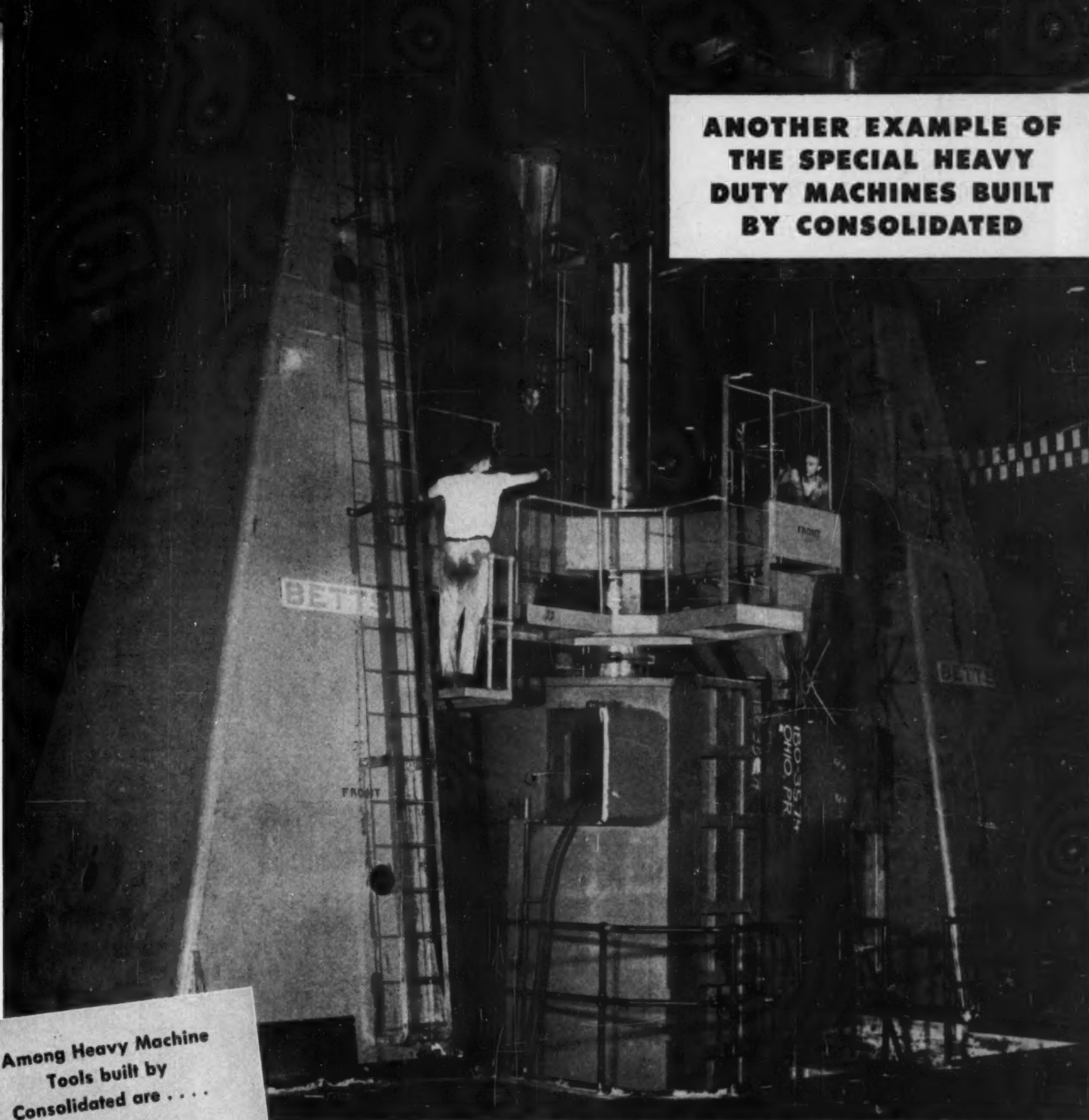
BETTS
BETTS

Orange Roller Bearing Co., Inc., Orange, N. J.
Standard Pressed Steel Co., Jenkintown, Pa.

BEARINGS, Needle

C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Orange Roller Bearing Co., Inc., Orange, N. J.
Torrington Co., Torrington, Conn.

BEARINGS, Roller

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Fafnir Bearing Co., New Britain, Conn.
Hyatt Bearings Div., Harrison, N. J.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Orange Roller Bearing Co., Inc., Orange, N. J.
Rollway Bearings Co., Inc., 541 Seymour St., Syracuse, N. Y.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Self-Lubricating (Oilless)

Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Johnson Bronze Co., New Castle, Pa.

BEARINGS, Tapered Roller

C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Kaydon Engineering Corp., McCracken St., Muskegon, Mich.
Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BEARINGS, Thrust

Aetna Ball & Roller Bearing Co., 4612 Schubert Ave., Chicago, Ill.
Ball & Roller Bearing Co., Danbury, Conn.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Fafnir Bearing Co., New Britain, Conn.
General Electric Co., Schenectady, N. Y.
Kaydon Engineering Corp., McCracekn St., Muskegon, Mich.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Marlin-Rockwell Corp., 402 Chandler Bldg., Jamestown, N. Y.
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Timken Roller Bearing Co., Canton, Ohio.
Torrington Co., Torrington, Conn.

BELT SHIFTERS

Standard Pressed Steel Co., Jenkintown, Pa.

BELTING TRANSMISSION

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

BENCHES, Work, and Bench Legs

Standard Pressed Steel Co., Jenkintown, Pa.

BENDING MACHINES, Angle Iron, Plate, Etc.

Consolidated Mch. Tool Corp., 565 Blossom Rd., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
O'Neil-Irwin Mfg. Co., Lake City, Minn.

BENDING MACHINES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.

(*Continued on page* 298)


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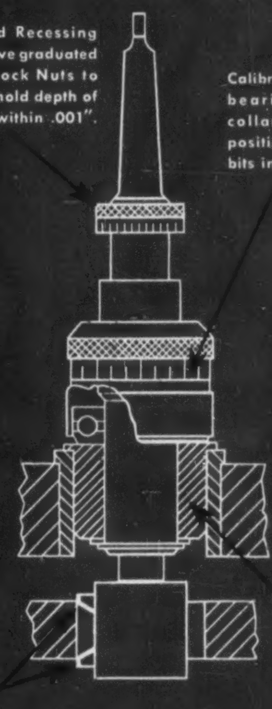

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Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Sta., Buffalo, N. Y.
Morgan Engineering Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

BENDING MACHINES, Pipe

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Pines Engineering Co., Inc., Aurora, Ill. (Hydraulic)
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BLAST CLEANING EQUIPMENT

Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
Pangborn Corp., Hagerstown, Md.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

BLOWERS

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

BOILER TUBES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Steel and Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

BOLT AND NUT MACHINERY

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Machine Co., Inc., Waynesboro, Pa.
National Machinery Co., Tiffin, Ohio.
New Britain Machine Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BOLTS AND NUTS

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Ottemiller, W. H., & Co., York, Pa.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

BOLTS, T-Slot

O. K. Tool Co., Milford, N. H.
Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.

BOOKS, Technical

Industrial Press, 148 Lafayette St., New York 13, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.

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Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Canedy-Otto Div. Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.

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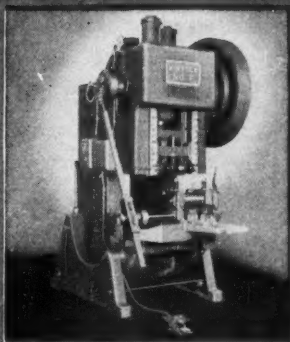

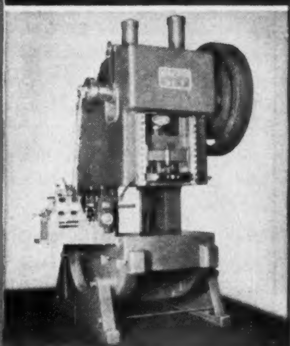

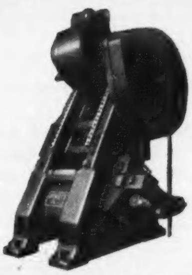

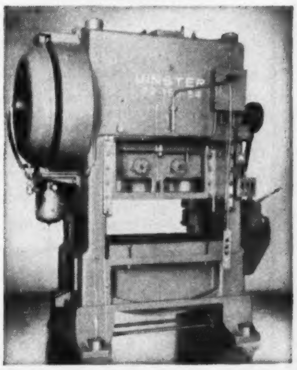

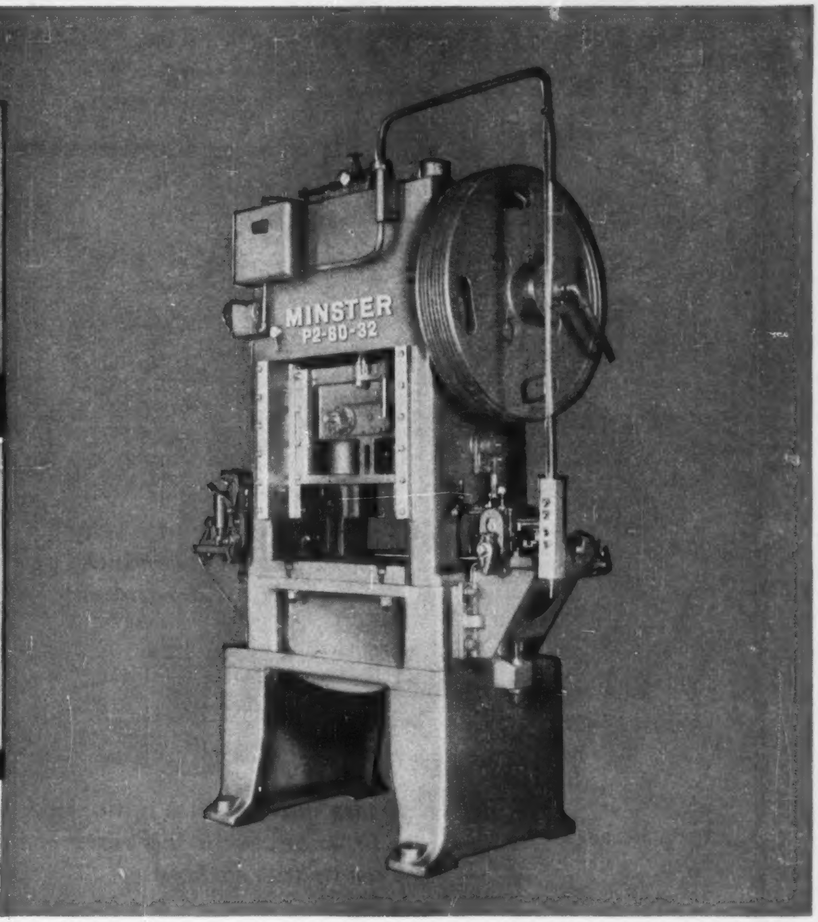

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American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

BORING BARS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Homestrand, Inc., Larchmont, N. Y.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

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Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R., Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Lucas Mch. Tool Div., New Britain Mch. Co., 12302 Kirby Ave., Cleveland 8, Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Portage Mch. Co., Sweitzer Ave., Akron 11, O.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

BORING HEADS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Mummert-Dixon Co., Hanover, Pa.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

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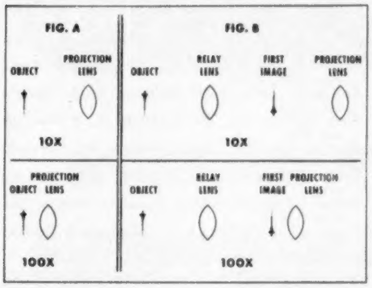
Plain Pointers on Projection

ALTHOUGH we frequently speak of magnifying an object 100× with the Kodak Contour Projector, technically we do not magnify the object at all. Instead we magnify its image, as formed by a relay lens. This relay system, diagrammed in Fig. B, forms an image of the object at a ratio of 1 to 1. The magnifying optics in turn pick up this image and enlarge it from 10 to 100 times.

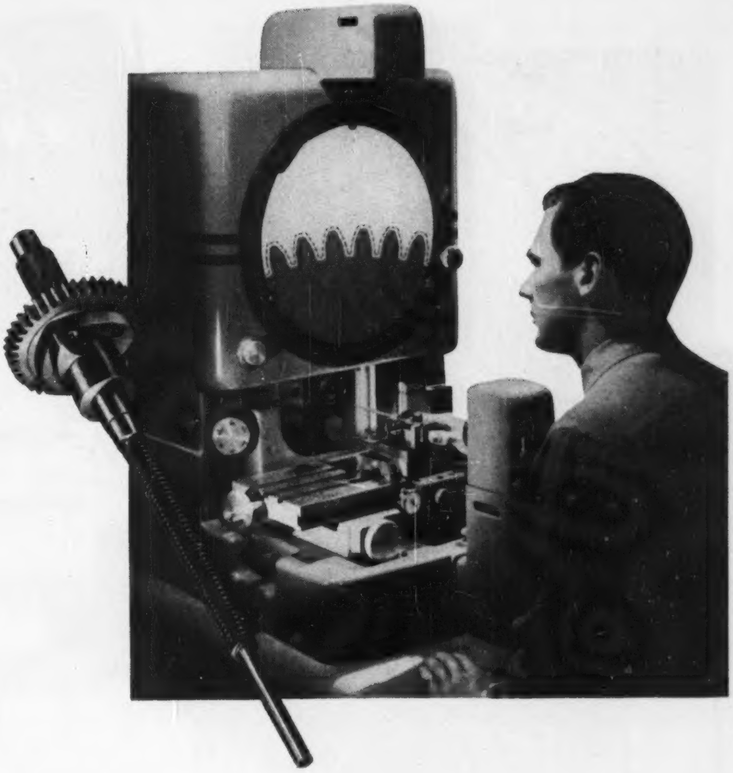
Since the end result is the same—an enlarged image of a part on the screen—this might seem a roundabout system to the uninitiated. On the contrary, there are logical mathematical reasons for it. One of the more restrictive factors in conventional optical systems is expressed by the formula, M = id/od; that is, magnification equals the ratio of the image distance to the object distance. In practice, where image distance is limited, this entails using lenses of short



focal length for high magnifications. The lens is moved close to the work, decreasing object distance and unfortunately decreasing at the same time the size part which may be checked (Fig. A).

It was to overcome this limitation that our optical experts incorporated the relay system in the Kodak Contour Projector. Since this system merely images the part at unity, the focal length of the relay lens can be comparatively long—in this case eight inches. And the magnifying optics can be moved as close as desired to the image formed by the relay. As a result, users of our projector have a full eight inches in which parts may be staged, regardless of the magnification desired. This permits checking form tools, shafts, and other bulky parts.

If this were all that the relay accomplished, it would be justified design wise. However, it also makes it practical to incorporate in the projector a lens turret in which lenses of varying magnifying power may be mounted. With such a turret, magnification is changed by merely twisting a dial and the part remains in focus at the new magnification. This is a handy feature, and only one of a number of optical features of the Kodak Contour Projector to be discussed in this space.



You can inspect long parts at all magnifications ...with the Kodak Contour Projector

THIS seven-inch-long cycle timing part must be inspected for tooth contour, location and spacing of two cams, shaft diameter, shoulder spacing, and form, size, and runout of the lead screw. All these dimensions may be quickly checked on the Kodak Contour Projector. That's because the Kodak Contour Projector provides an unvarying 8" clearance between lens and object at all magnifications. (The column at the left tells you why.)

The exceptional versatility of the Kodak Contour Projector permits this part to be completely inspected in six positions, at several different magnifications, and using both surface illumination and silhouette projection. And the job requires little training, is done quickly and easily.

Whether for toolroom use or production assembly and inspection, you'll find a Kodak Contour Projector will get the work out in a hurry. With an appropriate chart-gage and fixture you can inspect all sorts of complex parts, large and small. There is a field representative in your area who will answer your questions. To get in touch with him, or for a copy of a new booklet, "Kodak Contour Projector," write to:

Special Products Sales Division
EASTMAN KODAK COMPANY
Rochester 4, N. Y.

the KODAK CONTOUR PROJECTOR

Optical Gaging

A new sound movie, Optical Gaging, shows how to simplify complex inspection problems. We'll tell you how to get it for a showing.

Kodak

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Chandler Tool Co., 514 Ohio Ave., Muncie, Ind.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.

BORING MACHINES, Jig

American Sip Corp., 100 E. 42nd St., New York 17, N. Y.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kearney & Trecker Corp., Milwaukee, Wis.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

BORING TOOLS

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
American Steel Foundries, King Mch. Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit, Wis.
Giddings & Lewis Mch. Tool Co., Fond du Lac, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lovejoy Tool Co., Inc., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engineering Co., Frankenmuth 2, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

BRAKES, Press and Bending

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss, E. W., Co., 1375 Raff Road, S. W., Canton, Ohio.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Columbia Machinery & Engrg. Corp., Hamilton 1, O.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Peck, Stow & Wilcox Co., Southington, Conn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

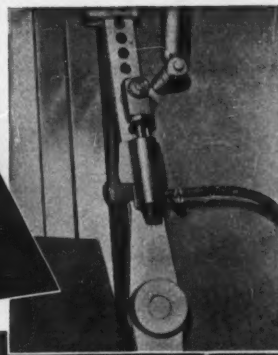
BROACHES

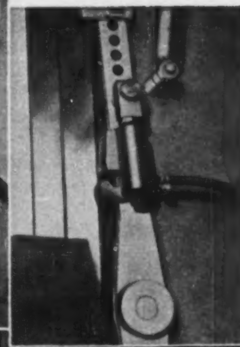
American Broach & Mch. Co., Ann Arbor, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Detroit Broach Co., 20201 Sherwood Ave., Detroit, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.

(Continued on page 304)

CECO-DROP SHORT STROKE CONTROL

"Makes the Hammer Talk!"

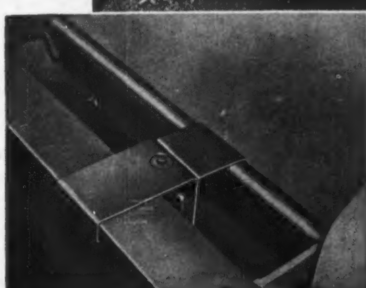




An installation of a Short Stroke Control on a 2500 lb. CHAMBERSBURG CECO-DROP HAMMER is shown, forging steel ankle joints for leg braces. Above are samples of the forging as it appears during various stages. The forging process begins with a series of 20 to 23 short, rapid blows (about 18" stroke) to draw the 11/2" dia. stock. This is followed by two long blows (about 35" stroke) to roll it, three more long blows in the rough impression, and three more long blows to complete the forging. After the last blow the ram is stopped on the up-stroke at the "short blow" position for the next forging.

Short Stroke Control is but one of the many features of Chambersburg CECO-DROPS. These piston lift, gravity drop hammers are setting new standards in forge shop production. Lower operating costs, minimum down time, easy operation, wide range of operations, extra safety; all add up to "more forging per hour" the basis on which to judge the efficiency of a Drop Hammer. Write for Bulletin 11-L-0.

CHAMBERSBURG ENGINEERING COMPANY
CHAMBERSBURG, PA.



(Above right) Dog in full stroke Position. Wedge is lifted, Short Stroke Control is inoperative.

(Above left) Dog in Short Stroke Position. Wedge is down, holding dog in operating position.

(Lower left) Button on treadle when depressed by operator shortens the stroke. Release reverts to full stroke.

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Cincinnati Milling Mch. Co., Cincinnati, Ohio.
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Consolidated Mch. Tool Corp., Rochester, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Lapointe Mch. Tl. Co., Tower St., Hudson, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

BRONZE

American Brass Co., Waterbury 20, Conn.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Johnson Bronze Co., New Castle, Pa.

BRUSHES, Industrial, Wire Wheel, Etc.

Osborn Mfg. Co., 5401 Hamilton Ave., Cleveland, Ohio.

BUFFERS

Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md. (Portable Elec.).
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.

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Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd., and Tennessee Ave., Cincinnati, Ohio.
Atrax Co., Newington, Conn.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

BURS

See Files and Burs, Rotary

BUSHINGS, Brass, Bronze, Carbide, Etc.

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Johnson Bronze Co., New Castle, Pa.
Kennametal, Inc., Latrobe, Pa.

BUSHINGS, Hardened

Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
U. S. Steel Co., Inc., 436 7th Ave., Pittsburgh, Pa.

BUSHINGS, Jig

Colonial Bushings, Inc., 31780 Groesbeck Hwy., Fraser, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Universal Engrg. Co., Frankenmuth, Mich.

CABINETS, Tool

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

(Continued on page 306)

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Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

CAM CUTTING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Fellows Gear Shaper Co., Springfield, Vt.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
New England Mch. & Tl. Co., Berlin, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

CAM MILLING AND GRINDING MACHINES

Landis Tool Co., Waynesboro, Pa.
New England Mch. & Tl. Co., Berlin, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rowbottom Machine Co., Sheffield St., Waterville, Waterbury, Conn.

CAMS

Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kux Mch. Co., 3930-44 W. Harrison St., Chicago, Ill.
Rowbottom Machine Co., Sheffield St., Waterville, Waterbury, Conn.

CARBIDES, TANTALUM, TITANIUM AND TUNGSTEN

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wesson Metal Corp., Lexington, Ky.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

CASEHARDENING FURNACES

See Furnaces, Heat-Treating.

CASTINGS, Aluminum, Brass, Bronze, Magnesium, Etc.

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co. (Brass and Bronze only), Bethlehem, Pa.
Bunting Brass & Bronze Co., Spencer and Carlton Aves., Toledo, Ohio.

CASTINGS, Die

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., Waterbury 20, Conn.
Madison-Kipp Corp., Madison, Wis.

CASTINGS, Iron

Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engineering Co., Chambersburg, Pa.
Hansell-Elcock Co., 485 W. 23rd Place, Chicago 16, Ill.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.

CASTINGS, Steel, Alloys, Etc.

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Lebanon Steel Foundry, Dept. J, Lebanon, Pa.
Link-Belt Co., 180 W. Duncannon Ave., Philadelphia 20, Pa.
U. S. Steel Corp., Columbia Steel Co., Div., 436 7th Ave., Pittsburgh, Pa.

(Continued on page 308)

CEMENT, Disc Grinding Wheel

Walls Sales Corp, 333 Nassau Ave., Brooklyn 22, N. Y.

CENTERING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Jones & Lamson Mch. Co., Springfield, Vt.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

CENTERS, Lathe

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHAINS, Power Transmission and Conveyor

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

CHISELS AND CHISEL BLANKS

Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Thor Power Tool Co., Aurora, Ill.

CHUCKING MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., (Multiple Spindle), Kennsington, Conn.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
National Acme Co., (Multiple Spindle), 170 E. 131st St., Cleveland, Ohio.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

CHUCKS, Air Operated

Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Durable Products, 816 W. 50th St., Minneapolis 19, Minn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
Schrader's Son, A., 470 Vanderbilt Avenue, Brooklyn, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Tomkins-Johnson Co., Jackson, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(Continued on page 310)

CHUCKS, Collet or Split
See Collets

CHUCKS, Diaphragm
Van Norman Co., 2640 Main St., Springfield 7, Mass.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Drill
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ettco Tool Co., Inc 592 Johnson Ave., Brooklyn, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CHUCKS, Full Floating
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, Staten Island, N. Y.
Gisholt Mch. Co., Madison 10, Wis.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Gear
Horton, E., & Son Co., Windsor Locks, Conn.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

CHUCKS, Lathes, Etc.
Buck Tool Co., 220 Schippers La., Kalamazoo, Mich.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Cushman Chuck Co., Windsor Ave., Hartford 2, Conn.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., Madison 10, Wis.
Jacobs Mfg. Co., West Hartford, Conn.
Jones & Lamson Mch. Co., Springfield, Vt.
Horton, E., & Son Co., Windsor Locks, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

CHUCKS, Magnetic
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Hanchett Magna-Lock Corp., Big Rapids, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

CHUCKS, Power Operated
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CHUCKS, Quick Change and Safety
Clarkson, Inc., 320 Ontario St., Toledo, O.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Jarvis, Charles L., Co., Middletown, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Universal Engineering Co., Frankenmuth 2, Mich.

CHUCKS, Ring Wheel
Gardner Mch. Co., Div. Landis Tool Co., 414 E. Gardner St., Beloit, Wis.

CHUCKS, Tapping
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.

(Continued on page 312)

Homestrand, Inc., Larchmont, N. Y.
Jacobs Mfg. Co., West Hartford, Conn.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.

CIRCUIT-BREAKERS

General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

CLAMPING APPLIANCES FOR MACHINE TOOLS

Neise, Karl A., Dept. M, 381 Fourth Ave.,
Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

CLAMPS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Mead Specialties Co., 4114 N. Knox Ave., Chicago 41, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Standard Shop Equipment Co., Inc., 8299 W. Tinicum Ave., Philadelphia, Pa.
Starrett, The L. S., Co., Athol, Mass.
Swartz Tool Products Co., Inc., 13330 Foley Ave., Detroit, Mich.

CLEANERS, Chemical, for Metal

Bullard Co., Bullard-Dunn Process Div., Brewster St., Bridgeport 2, Conn.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

CLUTCHES

Clearing Mch. Corp., 6499 W. 65th St., Chicago 38, Ill.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Formsprag Co., 23609 Hoover Rd., Van Dyke, Mich.
Link-Belt Co., 300 West Pershing Rd., Chicago 9, Ill.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Rockford Clutch Div., Borg-Warner Corp., 410 Catherine St., Rockford, Ill.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.

COLLARS, Safety

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Standard Pressed Steel Co., Jenkintown, Pa.

COLLETS

Brown & Sharpe Mfg. Co., Providence, R. I.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Gisholt Mch. Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave, Elmira, N. Y.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg. Co., Frankenmuth 2, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

COMPARATORS

See Gages, Comparator.

COMPARATORS, Optical

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Eastman Kodak Co., Rochester, N. Y.
Jones & Lamson Mch. Co., Springfield, Vt.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

COMPOUNDS, Cleaning

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

(Continued on page 314)

COMPOUNDS, Cutting, Grinding, Metal Drawing, Etc.

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Broaching & Lapping).
Oakite Products, Inc, 19 Rector St., New York, N. Y.
Sinclair Refining Co., 630 5th Ave., New York.
Standard Oil Co. (Indiana) 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St. Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

COMPOUNDS, Resin and Molding

Bakelite Co., Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.
General Electric Co., Schenectady 5, N. Y

COMPRESSORS, Air

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.

CONTOUR FOLLOWER

Turchan Follower Machine Co., 8259 Livernois and Alaska Aves., Detroit, Mich.

CONTRACT WORK

Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Diefendorf Gear Corp., 920 N. Belden Ave., Syracuse, N. Y.
Eisler Engrg. Co., Inc., 760 S. 13th, Newark 3, N. J.
Fellows Gear Shaper Co., Springfield, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland, Ohio.
Minster Machine Co., Minster Ohio.
Morse Twist Drill & Mch. Co., New Bedford Mass.
Mummert-Dixon Co., Hanover, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

CONTROLLERS

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

CONTROLS, THERMO

Control Products, Inc., 306 Sussex St., Harrison, N. J.

CONVEYORS FOR DUST, CHIPS, ETC.

Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Link-Belt Co., 300 W. Pershing Rd., Chicago 9, Ill.

COOLANT SEPARATORS

See Separators, Oil or Coolant

COUNTERBORES

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Besly-Welles Corp., Beloit, Wis.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling, Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.

(Continued on page 316)

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Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

COUNTERSHAFTS

Standard Pressed Steel Co., Jenkintown, Pa.

COUNTERSINKS

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Peck, Stow & Wilcox Co., Southington, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.

COUNTERS, Revolution

Brown & Sharpe Mfg. Co., Providence, R. I.
Millers Falls Co., Greenfield, Mass.
Starrett, The L. S. Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUNTING DEVICES

Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

COUPLINGS, Flexible

Boston Gear Works, 3200 Main St., North Quincy, Mass.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
James D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Philadelphia Gear Works, Erie Ave., and G St., Philadelphia, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

COUPLINGS, Shaft

Boston Gear Works, 3200 Main St., North Quincy, Mass.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Southwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Standard Pressed Steel Co., Jenkintown, Pa.

CRANES, Electric Traveling

Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Morgan Engrg. Co., Alliance, Ohio.

CUTTER GRINDERS

See Grinding Machines, for Sharpening Cutters, Reamers, Hobs, Etc.

CUTTERS, Gear

Brown & Sharpe Mfg. Co., Providence, R. I.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 6, Mich.

(Continued on page 318)

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich. (Shaving).
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Waltham Mch. Wks., Newton St., Waltham, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Keyseater

Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

CUTTERS, Milling

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock St., Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Clarkson, Inc., 320 Ontario St., Toledo, O.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Douglas Tool Co., 2300 E. Nine Mile Rd., Hazel Park, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tl. Co., Rochester, Mich.
OK Tool Co., Milford, N. H.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tomkins-Johnson Co., Jackson, Mich.
Union Twist Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Willey's Carbide Tool Co., 1340 W. Verner Hwy., Detroit 1, Mich.

CUTTERS, Rotary

See Files & Burs, Rotary.

CUTTING COMPOUNDS

See Compounds, Cutting, Grinding, Etc.

CUTTING AND GRINDING FLUIDS

Cimcool Div., Cincinnati Milling Mch. Co., Cincinnati, Ohio.
Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.

(Continued on page 320)

Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Shear-Speed Chemical Products, Div. Michigan Tool Co., 14230 Birwood Ave., Detroit 4, Mich.
Sinclair Refining Co., 630 5th Ave., New York.
Standard Oil Co., (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

CUTTING-OFF MACHINES

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Windsor, Vt. (Lathe Type).
Consolidated Mch. Tool Co., Rochester, N. Y.
Landis Machine Co., Waynesboro, Pa. (Pipe).
Modern Machine Tool Co., 601 S. Water St., Jackson, Mich. (Lathe Type for Tubing).
Pines Engineering Co., Inc., Aurora, Ill.

CUTTING-OFF MACHINES, Abrasive Wheel

Campbell Mch. Div., American Chain & Cable, 929 Conn. Ave., Bridgeport, Conn.
Columbia Machinery & Engrg. Corp., Hamilton 1, O.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.

CUTTING-OFF MACHINES, Cold Saw

See Sawing Machines, Circular.

CUTTING-OFF MACHINES, Metal Band Saws

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.

CUTTING-OFF TOOLS

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Kennametal, Inc., Latrobe, Pa.
Luers, J. Milton, 12 Pine St., Mt. Clemens, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

CUTTING-OFF WHEELS, Abrasive

Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester, Mass.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.

CYLINDER BORING MACHINES

Baker Bros., Inc., Sta. F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N.Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

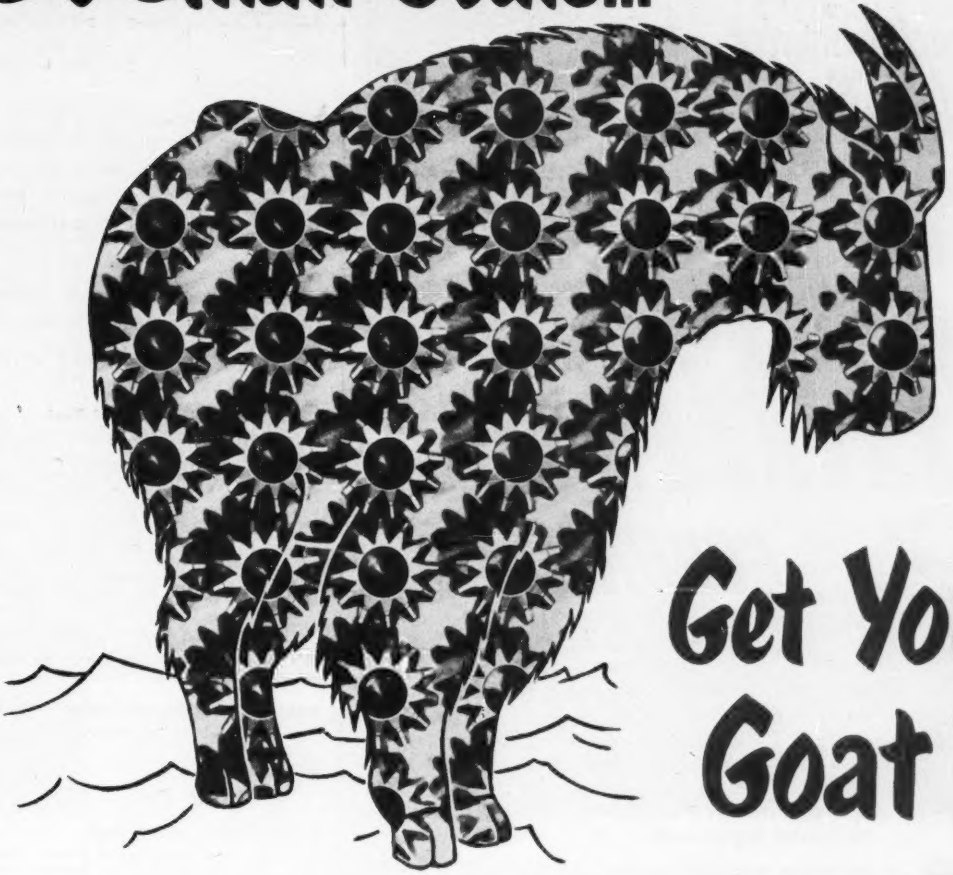
CYLINDERS, Air

Bellows Co., 230 W. Market St., Akron, Ohio.
Hannafin Corp., 1101 S. Kilbourn Ave., Chicago.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Tomkins-Johnson Co., Jackson, Mich.

CYLINDERS, Hydraulic

Barnes, John S., Corp., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., 810 Center Ave. Logansport, Ind.

(Continued on page 322)



Gear Specialties
GEAR Specialties, Inc.

National Forge & Ordance Co., Irvine, Warren County, Pa.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Tomkins-Johnson Co., Jackson, Mich.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DEALERS, Machinery

Botwinik Bros. of Mass., Inc., 14 Sherman St., Worcester, Mass.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

DEMAGNETIZERS

Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Heald Mch. Co., 10 New Bond St., Worcester 6, Mass.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Inc., Worcester, Mass.

DESIGNERS, Machine and Tool

Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIAMONDS AND DIAMOND TOOLS

Smit, J. K., & Sons, Inc., Murray Hill, N. J.

DIE-CASTING

See Castings, Die.

DIE-CASTING MACHINES

Hydraulic Press Mfg. Co., Mt. Gilead, Ohio.
Lake Erie Engineering Corp., Kenmore Station, Buffalo, N. Y.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.

DIE CUSHIONS

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Clearing Mch. Corp., 6499 W. 65th St., Chicago, Ill.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.

DIE INSERTS, Carbide

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

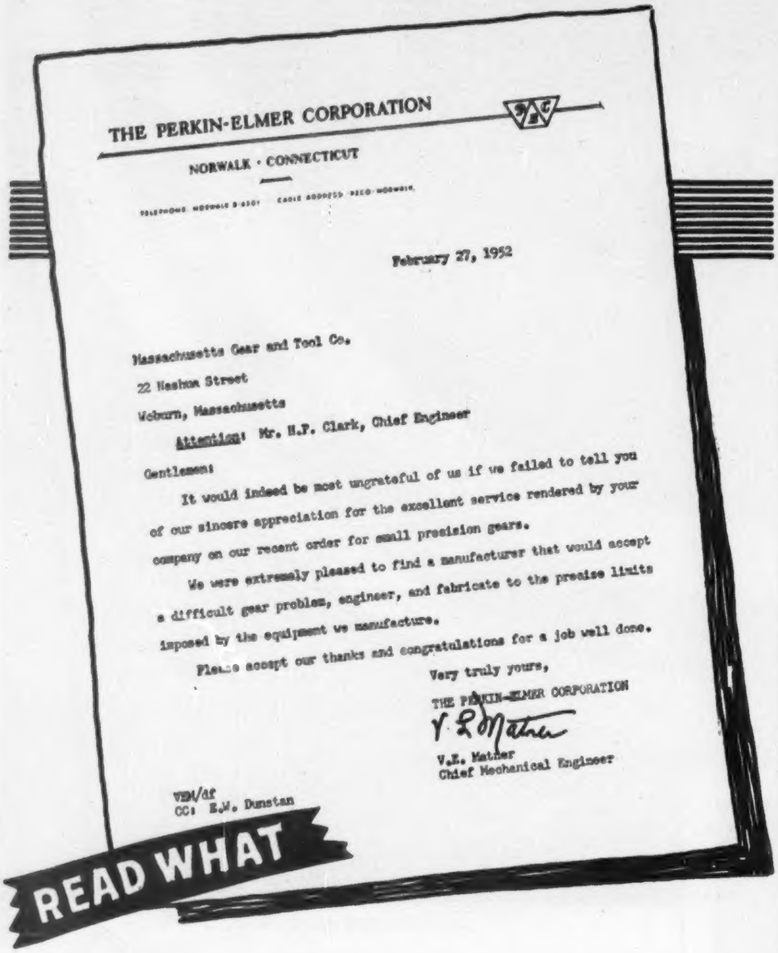
DIEMAKERS' SUPPLIES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DIEMAKING MACHINES

Grob Bros, Grafton, Wis.
Kearney & Trecker Corp., Milwaukee, Wis.
New England Mch. & Tl. Co., (Electronic) Berlin, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

(Continued on page 324)


THE PERKIN-ELMER CORPORATION

NORWALK · CONNECTICUT

February 27, 1952

Massachusetts Gear and Tool Co.
22 Hashua Street
Woburn, Massachusetts

Attention: Mr. H.P. Clark, Chief Engineer

Gentlemen:

It would indeed be most ungrateful of us if we failed to tell you of our sincere appreciation for the excellent service rendered by your company on our recent order for small precision gears.

We were extremely pleased to find a manufacturer that would accept a difficult gear problem, engineer, and fabricate to the precise limits imposed by the equipment we manufacture.

Please accept our thanks and congratulations for a job well done.

Very truly yours,

THE PERKIN-ELMER CORPORATION

V.L. Mather
Chief Mechanical Engineer

VEM/af
CC: E.W. Dunstan

Precise Products Corp., 1328-30 Clark St., Racine, Wis.

DIE SETS, Standard

Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.

DIE-SINKING MACHINES

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Cincinnati Milling Mch. Co., Cincinnati, Ohio
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

DIE-SINKING PRESSES

Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Kearney & Trecker Corp., Milwaukee, Wis.

DIE STOCKS

See Stocks, Die.

DIES, Lettering and Embossing

Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.

DIES, Sheet Metal, Etc.

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chambersburg Engrg. Co., Chambersburg, Pa.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Mch. Co., Bridgeton, N. J.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Metal Carbides Corp., Youngstown, Ohio.
Mullins Manufacturing Corp., Salem, Ohio.
Niagara Mch. & Tool Wks., 683 Northland Ave., Buffalo, N. Y.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Waltham Mch. Wks., Newton St., Waltham, Mass.

DIES, Threading

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Mansfield, Mass.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland,
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Winter Bros. Co., Rochester, Mich.

DIES, Threading, Opening

Eastern Mch. Screw Corp., New Haven, Conn.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Geometric Tool Co., Westville Station, New Haven 45, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

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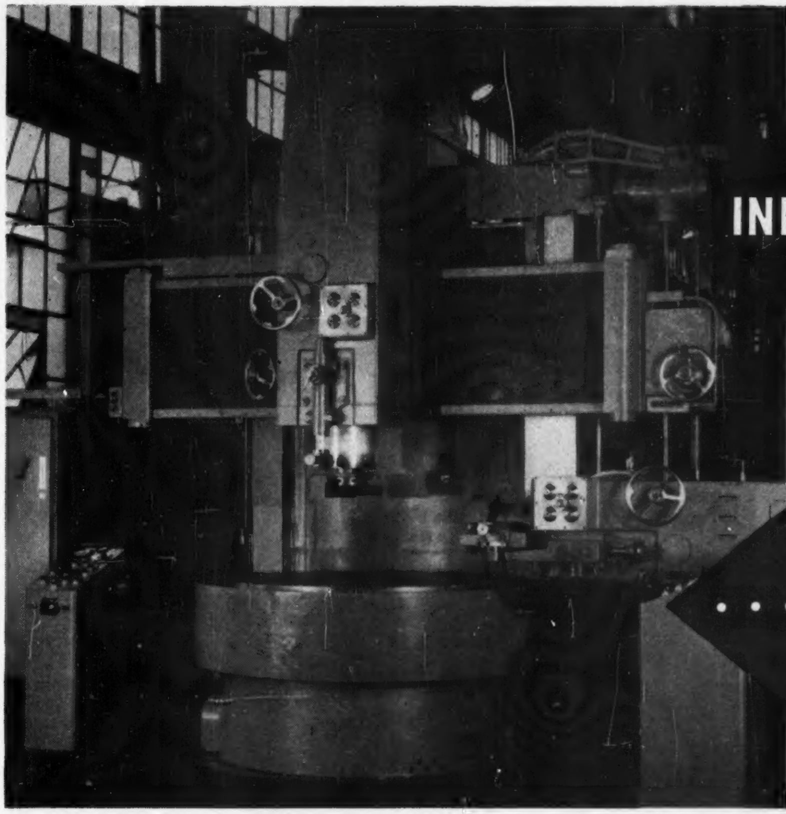

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Sufficient horsepower for regular machining cuts first . . .
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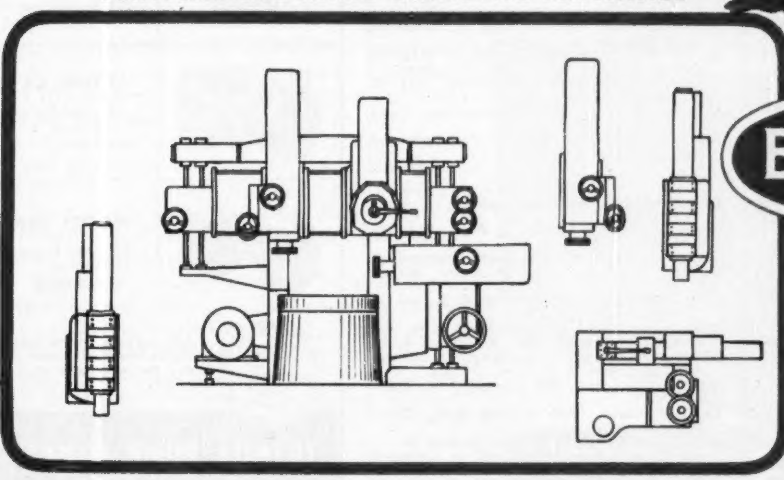


THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

DIES, Thread Rolling

Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

DISCS, Abrasives

Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Norton Co., 1 New Bond St., Worcester, Mass.
Simonds Abrasive Co., Tacony and Fraley Sts., Bridesburg, Philadelphia, Pa.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Walls Sales Corp., 333 Nassau Ave., Brooklyn 22, N. Y.

DIVIDING HEADS

See Indexing and Spacing Equipment

DOWEL PINS

Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Danly Mch. Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Detroit Die Set Corp., 2895A W. Grand Blvd., Detroit 2, Mich.
Producto Machine Co., 990 Housatonic Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

DRAFTING MACHINES

Universal Drafting Mch. Corp., 7960 Lorain Ave., Cleveland, Ohio.

DRESSERS, Grinding Wheel

Carboloy Dept., General Electric Co., Box 237 Roosevelt Park Annex, Detroit 32, Mich.
Erickson Tools, Div. Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hoglund Engrg. & Mfg. Co., Inc., Berkeley Heights, N. J.
Metal Carbides Corp., Youngstown, Ohio
Meyers, W. F., Co., Bedford, Ind.
Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
Norton Co., 1 New Bond St., Worcester, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio.

DRIFTS, Drill

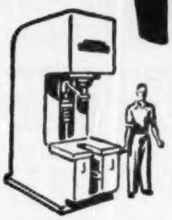
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL HEADS, Multiple Spindle

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Errington Mechanical Laboratory, 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.
United States Drill Head Co., 616 Burns, Cincinnati, Ohio.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

(Continued on page 328)

NOW Cost-cutting, servo-type



"touch control"

up to 75 tons

With this new and bigger

MULTIPRESS®

you can now have all of the operating advantages of the well-known Multipress line — plus the advantages of the new servo-type Touch Control... for applications up to 75 tons!

IDEAL FOR STRAIGHTENING, DIE SINKING, COMPACTION, ASSEMBLY. With this new heavy-duty *Touch Control* Multipress, you can make the ram travel fast or slow . . . stop or reverse it any time . . . hold it at any point . . . bear down on the work with a few pounds of pressure or all 75 tons . . . repeat pressures as rapidly as you can manipulate the hand levers . . . and hold pressure on the work for any needed dwell period.

Touch Control gives the operator a positive, direct "feel" of the operation — adds his own skill to the smooth, dependable accuracy of the Multipress ram. And he gets *instantaneous response* to every action of the hand lever.

Applied pressures are quickly and accurately shown on the dial gauge. Stroke length is fully adjustable at both upper and lower limits. Maximum tonnage can be preset at any pressure within the limits of the press.

The 75-ton Multipress offers a 30-inch daylight opening (or gap) . . . 34-inch work table width . . . 13-inch throat depth . . . and a ram stroke that's fully adjustable up to the 15-inch maximum. Height, only 106 inches. *Write today* for full details on this versatile, big-job Multipress with TOUCH CONTROL.

The DENISON Engineering Co.
1152 Dublin Road, Columbus 16, Ohio

DENISON HydrOILics

DRILL HEADS, Unit Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bellows Co., 230 W. Market St., Akron, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Keller Tool Co., Grand Haven, Mich.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

DRILL SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILL STANDS

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Thor Power Tool Co., Aurora, Ill.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLING MACHINES, Automatic

Avey Drilling Mch.. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., Mt. Grove St., Bridgeport, Conn.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Machinery Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Bench

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Dumore Co., 1300 17th St., Racine, Wis.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

(Continued on page 330)

DRILLING MACHINES, Boiler

Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.

DRILLING MACHINES, Deep Hole

Bellows Co., 230 W. Market St., Akron, Ohio.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.

DRILLING MACHINES, Gang

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K. Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.

DRILLING MACHINES, Horizontal Duplex

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Kingsbury Mch. Tool Corp., Keene, N. H.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

DRILLING MACHINES, Horizontal Portable

Cincinnati Bickford Tool Co., 3220 Forrer Ave. Cincinnati, Ohio.

DRILLING MACHINES, Inverted

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.

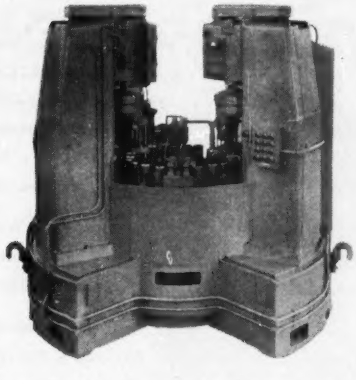
DRILLING MACHINES, Multiple Center Column Type

Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.

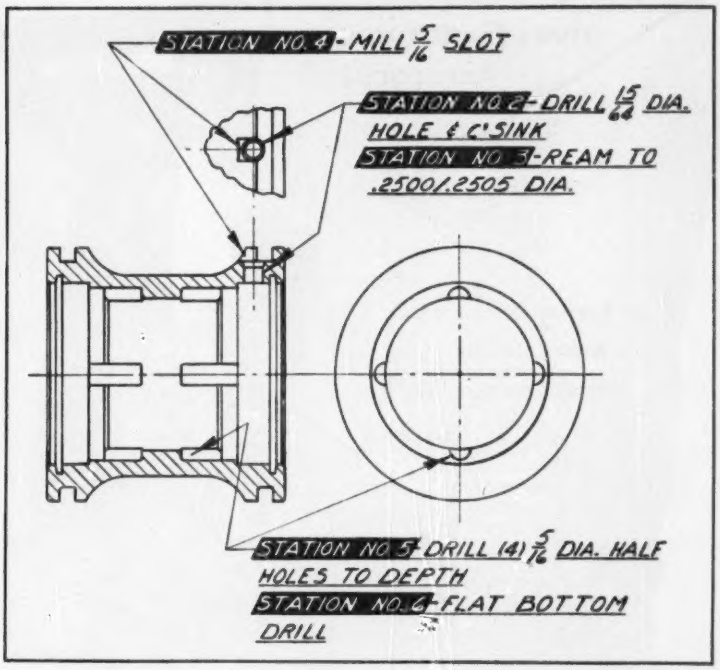
(Continued on page 332)

TURNER solves another *tough* production problem!

Special automatic indexing-type machine drills, reams, mills and countersinks 440 steering gear pistons per hour at 100% efficiency!



Turner's specially designed fixtures and multiple spindle heads account for the exceptional efficiency of this time-saving machine operation. An unusual feature of this particular fixture and clamping mechanism is the dead center indexing table mounting a stationary cam track. Rollers, attached to the fixture clamping mechanism, pass through as the table indexes. Limit switches, also attached to the center, make it impossible for the machine to operate unless the parts are clamped in place. In the close-up, at left, you will notice that the multiple spindle drill heads have guide pins which enter bushings in the fixture before the actual machining operation takes place. This insures extreme machining accuracy.



The sequence of operations is as follows:

Station 1: Operator places part in the RH side of the fixture and the machine indexes to Station 2.

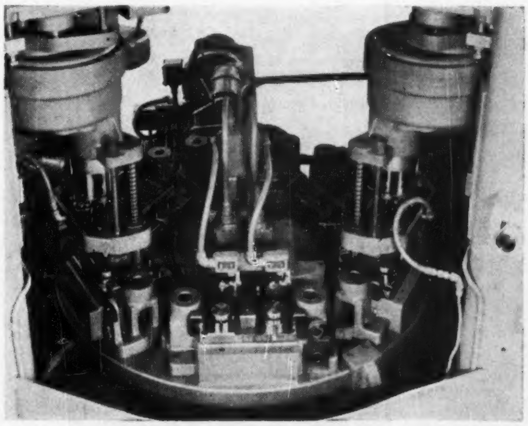
Station 2: (Four) 5/16" port holes are drilled to depth. At the same time, the next fixture has come into position at Station 1 and the loading operation is repeated. The first fixture moves to Station 3 and the (Four) 5/32" radius port holes are flat bottom drilled.

Station 4: The 5/16" slot is milled.

Station 5: The 15/64" hole is drilled and countersunk.

Station 6: The 15/64" hole is reamed to .2500/.2505".

The fixture is then indexed to starting Station 1 where the part is automatically unclamped, removed from the RH side of the fixture and placed end for end on the LH side of the fixture. At the same time, the new part is loaded onto the RH side of the fixture as in the first cycle of the machine. From this point on, the machine cycle is the same as previously described and for each complete cycle of the machine, the part will be completely machined as per the above operations.



Turner solves high production problems such as this by first studying the problem thoroughly, applying years of technical experience; then, by designing fixtures and spindle heads *exactly suited to your job.* With all Turner special purpose machines, standard bases and columns are used to keep manufacturing costs down. It means you are assured a machine specially designed for your application, yet without the high extra costs you might expect. Drop us a line; we'll be happy to look over your particular production problem.

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2625 HILTON ROAD
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DESIGNERS and BUILDERS of:
- SPECIAL MACHINES
- JIGS and FIXTURES

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo,
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Cosa Corp., 405 Lexington Ave., New York 17.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Greenlee Bros. & Co., 12th and Columbia Ave., Rockford, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

DRILLING MACHINES, Radial

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Carlton Mch. Tool Co., 3000 Spring Grove Ave., Cincinnati 25, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Kaukauna Machine Corp., Kaukauna, Wis.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.

DRILLING MACHINES, Rail

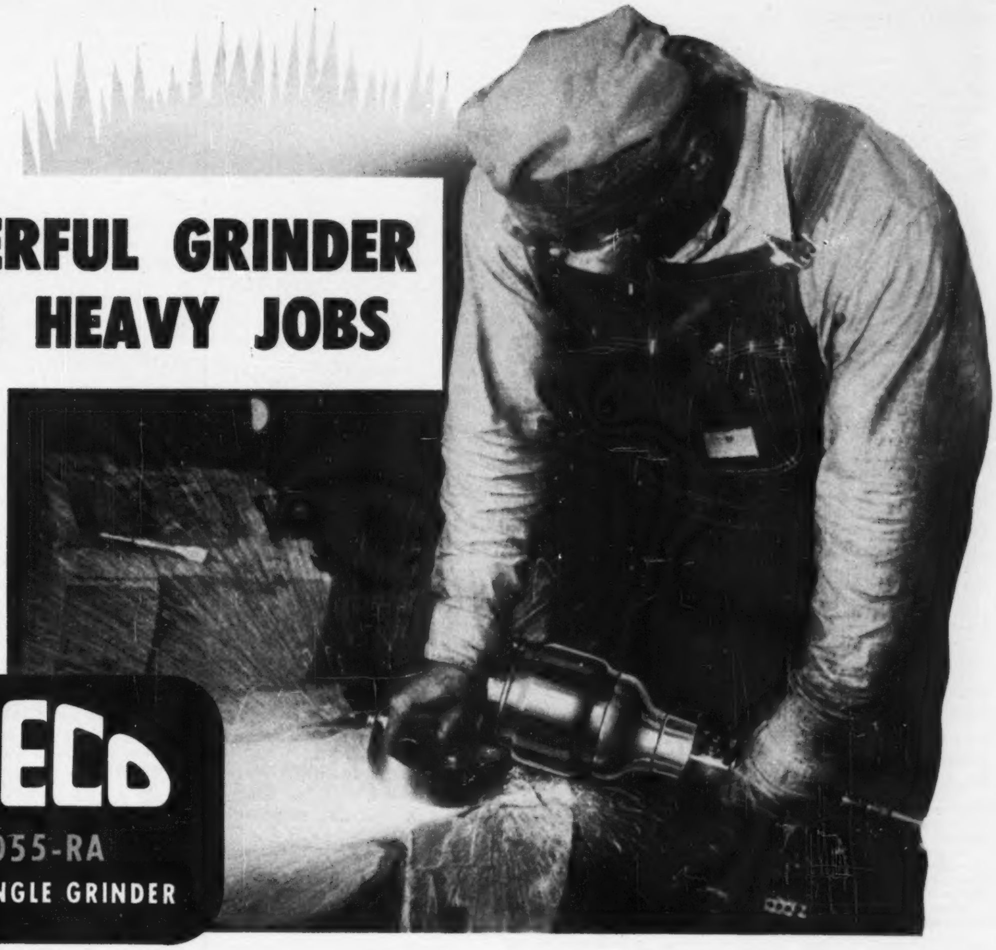
See Drilling Machines, Gang.

DRILLING MACHINES, Sensitive

Avey Drilling Mch. Co., 26 E. Third St., Covington, Ky.
Buffalo Forge Co., 490 Broadway, Buffalo, N.Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Pratt & Whitney, West Hartford 1, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

(Continued on page 334)

POWERFUL GRINDER FOR HEAVY JOBS



CLECO
5055-RA
RIGHT ANGLE GRINDER

This big, powerful grinder is ideal for heavy jobs. Its high power output and air-operated governor insure sustained operating speed—even under loads that would stall most grinders.

The Cleco 5055-RA is recommended for use on large castings, ship propellers and for cleaning heavy welds. On one job, for example, a heavy flame weld was normally chipped and then ground, the operation took 1½ to 2 hours. With the 5055-RA the chipping operation was unnecessary and the grinding took only 15 minutes.

If you have heavy work, write us and a Cleco representative will make an on-the-spot demonstration at your convenience.

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Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Mch. Tool Co., 156 Wason Ave., Springfield 7, Mass.
Buffalo Forge Co., 490 Broadway, Buffalo, N.Y.
Canedy-Otto Div., Cincinnati Lathe & Tool Co., Oakley, Cincinnati, Ohio.
Cincinnati Bickford Tool Co., 3220 Forrer Ave., Cincinnati, Ohio.
Cleereman Mch. Tool Co., Green Bay, Wis.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Foote-Burt Co., 1300 St. Clair Ave., Cleveland 8, Ohio.
Fosdick Mch. Tool Co., 1638 Blue Rock, Cincinnati 23, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
National Automatic Tool Co., Inc., S. 7th and N. Sts., Richmond, Ind.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Snow Mfg. C.., 435 Eastern Ave., Bellwood, Ill.
Snyder Too & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

DRILLING MACHINES, Wall Radial

Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.

DRILLS, Center

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Core

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Erickson Tools Div., Erickson Steel Co., 2309 Hamilton, Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

DRILLS, Deep Hole

Pratt & Whitney, West Hartford 1, Conn.
Smit, J. K., & Sons, Inc., Murray Hill, N. J.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Portable Electric

Black & Decker Mfg. Co., Towson, Md.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Dumore Co., 1300 17th St., Racine, Wis.
Millers Falls Co., Greenfield, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Portable Pneumatic

Bellows Co., 230 W. Market St., Akron, Ohio
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

DRILLS, Ratchet

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Twist

Besly-Weiles Corp., Beloit, Wis.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRILLS, Wire

Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

DRIVES, Chain

Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.

DUPLICATORS

Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
New England Mch. & Tl. Co., (Electronic) Berlin, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois, Detroit, Mich.

DUST COLLECTORS

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pangborn Corp., Hagerstown, Md.

DUST CONTROL SYSTEMS

Pangborn Corp., Hagerstown, Md.

ELECTRICAL EQUIPMENT

General Electric Co., Schenectady 5, N. Y.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

EMERY WHEEL DRESSERS

See Dressers, Grinding Wheel.

EMERY WHEELS See Grinding Wheels.

ENGRAVING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

EXTRACTORS, Screw

Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

FACING MACHINES

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.

FANS, Exhaust, Electric Ventilating

Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
General Electric Co., Schenectady 5, N. Y.

FEEDS FOR PRESSES, Automatic

Bellows Co., 230 W. Market St., Akron, Ohio.
Federal Press Co., 600 Division and Big Four R. R., Elkhart, Ind.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co, Div. Emhart Mfg. Co., Hudson, N. Y.

FELT, For All Applications

American Felt Co., Glenville, Conn.

FILES, Hack

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Hand

Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Heller Bros. Co., Newcomerstown, Ohio.
Nicholson File Co., 23 Acorn St., Providence, R. I.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.

FILES, Machine

Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILES AND BURS, Rotary

Jarvis, Chas. L., Co., Middletown, Conn.
Peck, Stow & Wilcox Co., Southington, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Thor Power Tool Co., Aurora, Ill.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FILING MACHINES, Dies, Etc.

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Grob Bros., Grafton, Wis.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Jarvis, Chas. L., Co., Middletown, Conn.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.

FILTERS, Air

Bellows Co., 230 W. Market St., Akron, Ohio.
Keller Tool Co., Grand Haven, Mich.

FILTERS, Coolant and Oil

Barnes Drill Co., 814 Chestnut St., Rockford, Ill
Cuno Engrg. Corp., Meriden, Conn.

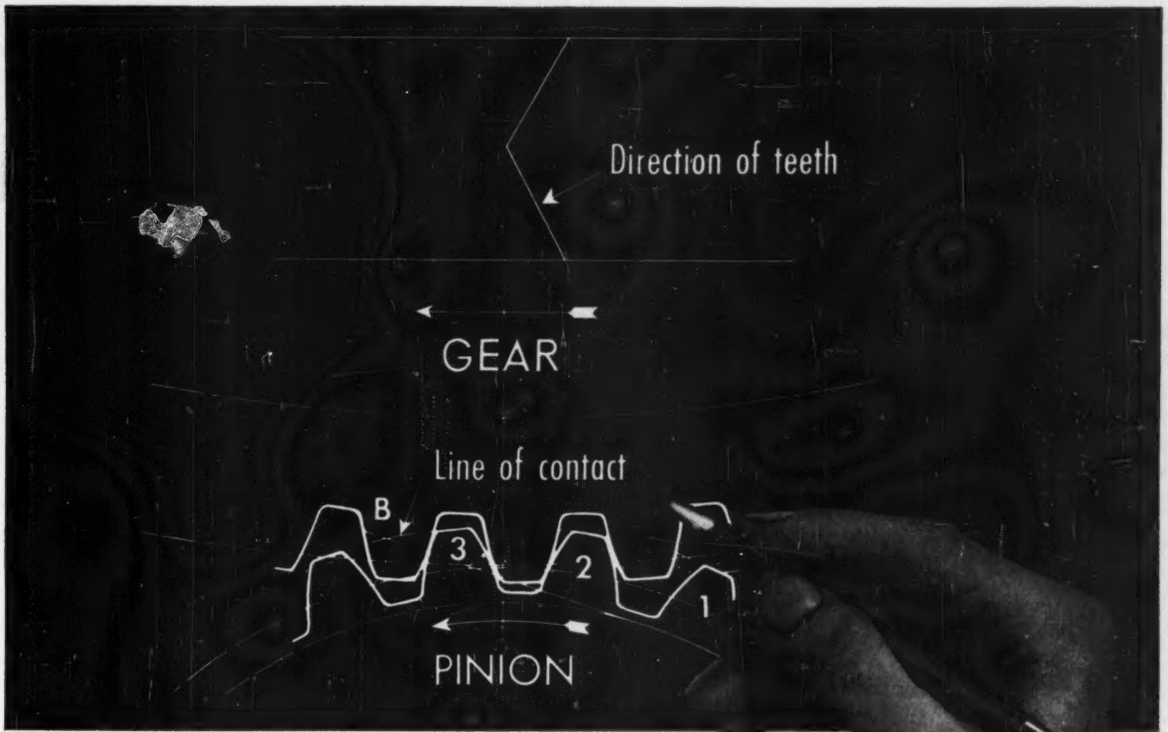
FINISHES FOR MACHINES AND METAL PARTS

Lowe Bros. Co., Dayton, Ohio.

FLEXIBLE COUPLINGS

See Couplings, Flexible.

(Continued on page 336)



These might be called the "life lines" of a gear

These "life lines" are the lines of contact between a pair of Farrel-Sykes gears. Because they are oblique across the face of each tooth, and the pressure is evenly distributed from tip to working depth line, there is no tendency for the teeth to wear unevenly. This is why Farrel-Sykes gears continue to operate smoothly after so many years of service.

The quiet, vibration-free performance of these gears results from the accuracy of tooth spacing, profile and helix angle, and other qualities inherent in the Farrel-Sykes method of gear generation. Precision manufacture and the use of highest grade materials also contribute to long gear life.

Farrel engineers are available to assist in working out unusual gear problems. Write for further information.

FARREL-BIRMINGHAM COMPANY, INC.
ANSONIA, CONNECTICUT

Plants: Ansonia and Derby, Conn., Buffalo, N. Y.
Sales Offices: Ansonia, Buffalo, New York, Boston, Akron, Detroit, Chicago, Memphis, Minneapolis, Portland (Oregon), Los Angeles, Salt Lake City, Tulsa, Houston, New Orleans

FB-845

Farrel-Birmingham®

Farrel-Sykes herringbone gears are made in any size from ¼" to 20'0" diameter, for any power capacity and speed. Also available are straight tooth and single helical gears in sizes up to 20 feet diameter, and large internal gears with either spur or helical teeth.

FLEXIBLE SHAFT EQUIPMENT
Dumore Co., 1300 17th St., Racine, Wis.
Jarvis, Chas. L., Co., Middletown, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

FORGING (Upsetting) MACHINES
Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
Baldwin-Lima-Hamilton Corp, Philadelphia 42, Pa.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

FORGINGS, Drop
Bethlehem Steel Co., Bethlehem, Pa.

FORGINGS, Hollow Bored
Bethlehem Steel Co., Bethlehem, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Iron and Steel
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Morgan Engrg. Co., Alliance, Ohio.
National Forge & Ordnance Co., Irvine, Warren County, Pa.

FORGINGS, Upset
Bethlehem Steel Co., Bethlehem, Pa.

FORMING AND BENDING MACHINES
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dreis & Krump Mfg Co., 7416 Loomis Blvd., Chicago 36, Ill.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc., 1700 E. Grand Ave., El Segundo, Calif. (Stretch-Wrap).
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Yoder Co., 5500 Walworth, Cleveland, Ohio.

FORMING AND STAMPING MACHINES
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co, Inc., 255 North 18th St., Ampere, N. J.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

FORMING TOOLS or Tool Blanks
Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Brown & Sharpe Mfg. Co., Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

FRAMES, Machinery Welded
Mahon, R. H., Co., Detroit 34, Mich.

FURNACES, Heat-Treating
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

FURNITURE, Shop
Standard Pressed Steel Co., Jenkintown, Pa.
Western Tool & Mfg. Co., 1640 E. Wheeler St., Springfield, Ohio

GAGE BLOCKS
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

GAGES, Air
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Comparator
Ames, B. C., Co., Waltham 54, Mass.
Comtor Co., 47 Farwell St., Waltham 54, Mass.
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co, 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Taft-Pierce Mfg. Co., Woonsocket, R. I.

GAGES, Depth
Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Pierce Mfg. Co., Woonsocket, R. I.

GAGES, Dial
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Electric
Cosa Corp., 405 Lexington Ave., New York 17.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GAGES, Height
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Plug, Ring and Snap
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Brown & Sharpe Mfg. Co., Providence, R. I.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York.
Kennametal, Inc., Latrobe, Pa.
Metal Carbides Corp., Youngstown, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros. Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Vinco Corp., 9113 Schaefer Hwy., Detroit 28, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GAGES, Surface
Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.

GAGES, Taper
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

GAGES, Thread
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Greenfield Tap & Die Corp., Greenfield, Mass.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A., Co., 1300 E. Nine Mile Rd., Detroit 20, Mich.

GASKETS
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

GEAR BLANKS, Non-Metallic
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
General Electric Co., Schenectady 5, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

GEAR BURNISHING MACHINES
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

GEAR CHAMFERING, ROUNDING AND BURRING MACHINES
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

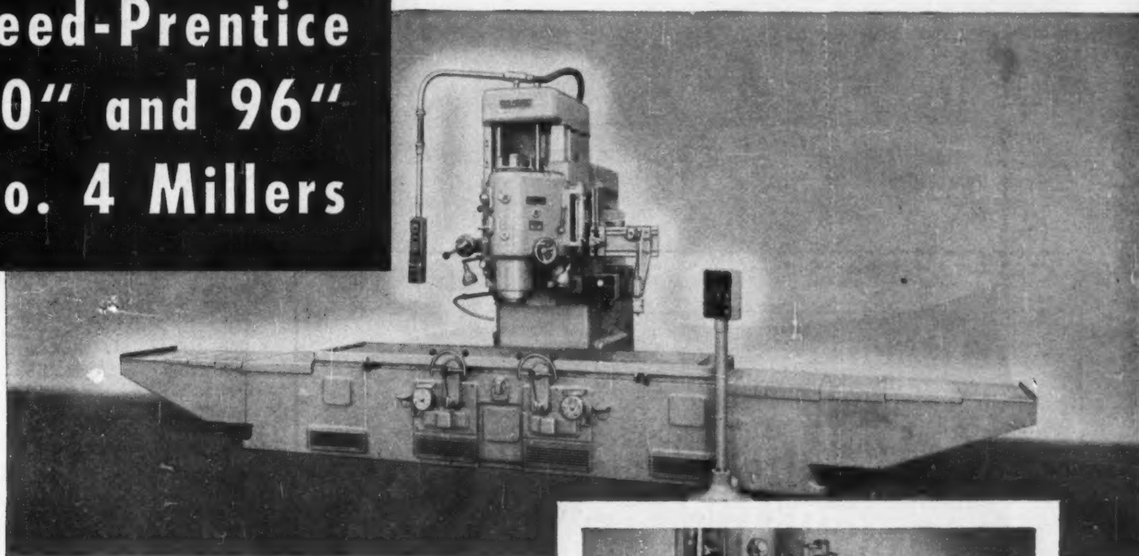
GEAR CHECKING INSTRUMENTS AND EQUIPMENT
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.

(Continued on page 338)

HEAVY-DUTY

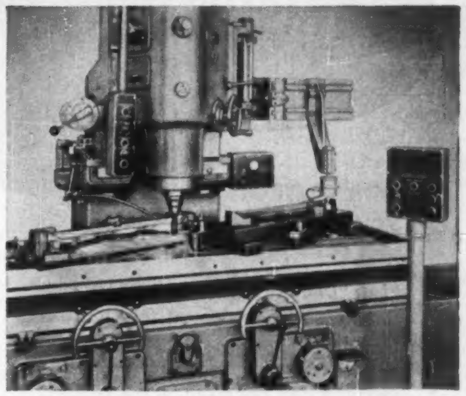
PRECISION PROFILING

on Reed-Prentice 60" and 96" No. 4 Millers



96" No. 4 Vertical Miller with two-dimensional Contouring Unit

Two-dimensional electronic contour follower system on No. 4 Miller duplicating aircraft part for Kaiser Manufacturing Company of Richmond, California.



Here's the ultimate in electronic machine control—at your fingertips! The Reed-Prentice No. 4 Vertical Miller, featuring electronic control for all feeds, provides unsurpassed accuracy in complex duplicating operations when equipped with a General Electric two or three-dimensional electronic contour follower system.

Today Reed-Prentice No. 4 Millers perform milling and profiling work for such leading manufacturers as General Motors Corp., Allis-Chalmers Mfg. Co., Chrysler Corp., Kaiser Mfg. Corp., Westinghouse Electric Corp. and National Pressure Cooker Co.

SPECIFICATIONS		#4-60"	#4-96"
Longitudinal travel of table		60"	96"
Travel of cross slide		24"	24"
Table working surface		24 x 96"	24 x 132"
Feed range		½ to 25" per minute	
Spindle speeds:	20 H.P. motor		45-1800 RPM
	25 or 30 HP motor		90-1800 RPM

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Buffalo . J. L. Osgood Machinery Corp.
Detroit . . . . DoAll Detroit Co.
Grand Rapids . DoAll Grand Rapids Co.
Chicago . . . . . . DoAll Mid-West Co.
Milwaukee . . . . DoAll Wisconsin Co.
Minneapolis . . . . Chas. W. Stone Co.
Houston . Preston Machine Tool Sales Co.
San Francisco . . Montague-Harris Co.
Los Angeles . . . . King Machinery Co.

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REED-PRENTICE CORP.
WORCESTER MASS. U.S.A.

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BRANCH OFFICES
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1213 West 3rd St., Cleveland 13, Ohio
4001 N. Elston Ave., Chicago 18, Illinois
2842 W. Grand Blvd., Detroit 2, Michigan

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Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

GEAR CUTTING MACHINES, Bevel Gears (Generators)

Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR CUTTING MACHINES Bevel Gears, Spiral

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR CUTTING MACHINES, Spur and Bevel Gears (Rotary Cutter)

Waltham Machine Works, Newton St., Waltham, Mass.

GEAR CUTTING MACHINES, Spur and Helical Gears (Hobbing)

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

GEAR CUTTING MACHINES, Spur and Helical Gears (Shaper or Planer Type)

Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR CUTTING MACHINES, Worm and Worm Wheels

Barber-Colman Co., Rock and Montague, Rockford, Ill.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt. (Straight and Hourglass Types).
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR FINISHING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR GRINDING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., Springfield, Mass.

GEAR HARDENING MACHINES

Gleason Works, 1000 University Ave., Rochester 3, N. Y.

GEAR LAPPING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR MOTORS

See Speed Reducers.

GEAR SHAVING MACHINES

Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
Shear-Speed Chem. Prod. Div. Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.

GEAR TESTING MACHINERY

Baldwin-Lima-Hamilton Corp., Philadelphia 42 Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Eastman Kodak Co., Rochester, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave Cleveland, Ohio.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

GEARS, Cut

American Stock Gear Div., Perfection Gear Co., Harvey, Ill.
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Automotive Gear Works, Inc., Richmond, Ind.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Boston Gear Works, 3200 Main St., North Quincy, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Braun Gear Co., 239 Richmond, Brooklyn 8, N. Y.
Cincinnati Gear Co., Wooster Pike and Mariemont Ave., Cincinnati, Ohio.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears Div., Michigan Tool Co., 7200 E. McNichols Rd., Detroit, Mich.
Diefendorf Gear Corp., 920 N. Beldon Ave., Syracuse, N. Y.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Franke Gear Works, Inc., 1924 W. Columbia Ave., Chicago 26, Ill.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Gleason Works, 1000 University Ave., Rochester 3, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.

(Continued on page 340)

Prove It To Yourself!

...You Can Now Obtain Precision Flatness, Finish and Parallelity in Production Quantities

Many manufacturers of pumps, compressors, valves and other equipment containing liquids or air under high pressures are now using production lapping to great advantage—have eliminated gaskets in mating surfaces, have improved product performance. This has been made possible through the extreme accuracy of work produced by the Lapmaster in production quantities. Micro-inch finishes of 2 to 3 RMS are common. Surface flatness can be held to less than .0000116″.

Use Our
Free Laboratory Service
to Determine Your Exact Needs

To determine whether lapping can be practical and profitable for you, we maintain a laboratory for lapping sample parts. If you believe it offers possibilities we invite you to send prints of the parts, together with surface finish requirements and production desired. In addition send several parts for test lapping. We can then give you the facts on what you can expect from the Lapmaster. There is no obligation for this service.

A TYPICAL CASE

Four Model 72″ Lapmasters were installed in an automotive plant for lapping the joint faces on large castings. These Lapmasters are able to keep pace with the high production requirements of automotive plants because there is no downtime required for reconditioning the lapping plate. In addition, parts lapped by the Lapmaster can be brought directly from the milling operation to lapping. Intermediate grinding operations are eliminated. Still another important feature is the fact that joint faces are lapped so accurately, gaskets can be eliminated in final assembly; the resulting metal to metal contact also eliminates distortion caused by the conventional use of gaskets.

Additional Data

on the complete line of Lapmasters is available on request, also new information on Measuring Flatness. Write for your copies today.

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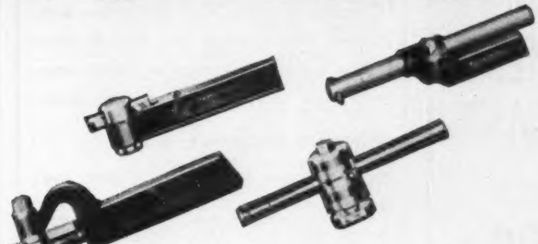

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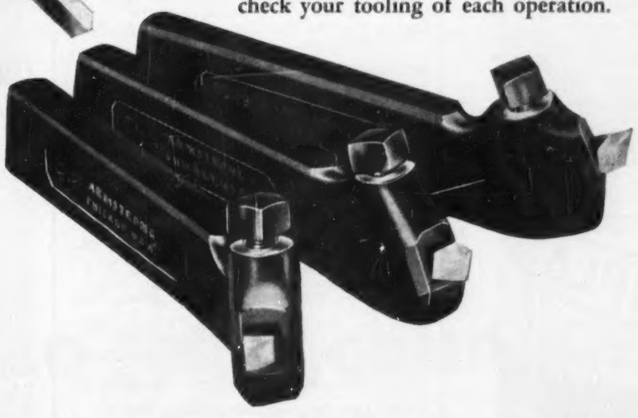

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Van Norman Co., 2640 Main St., Springfield 7, Mass.

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Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Mattison Machine Works, Rockford, Ill.
Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
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Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Landis Tool Co., Waynesboro, Pa.

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Pratt & Whitney, West Hartford 1, Conn.
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Oliver Instrument Co., 1410 E. Maumee St., Adrian, Mich.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
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Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
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Moore Special Tool Co., Inc., 724 Union Ave., Bridgeport, Conn.
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Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
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Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Mattison Machine Works, Rockford, Ill.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.

GRINDING MACHINES, Roll
Farrel-Birmingham Co., 25 Main St., Ansonia, Conn.
Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
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Norton Co., 1 New Bond St., Worcester 6, Mass.

GRINDING MACHINES, Spline Shaft
Van Norman Co., Springfield, Mass.

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Arter Grinding Mch. Co., 15 Sagamore Rd., Worcester 5, Mass.
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Gallmeyer & Livingston Co., 336 Straight Ave., S. W., Grand Rapids 4, Mich.
Gardner Machine Co., 414 E. Gardner St., Beloit, Wis.
Heald Machine Co., 10 New Bond St., Worcester 6, Mass.
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Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Mattison Machine Works, Rockford, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
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Pratt & Whitney, West Hartford 1, Conn.
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Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
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Thompson Grinder Co., 1500 W. Main St., Springfield, Ohio
Thor Power Tool Co., Aurora, Ill.
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Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

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Kodiak Corp., 801 Caxton Bldg., Cleveland 15, Ohio.
Landis Tool Co., Waynesboro, Pa.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

GRINDING MACHINES, Worm
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Chambersburg Engrg. Co., Chambersburg, Pa.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.

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Keller Tool Co., Grand Haven, Mich.
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Ipsen Industries, Inc., 536 N. Madison, Rockford, Ill.

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See Gear Cutting Machines, Spur and Helical Gears (Hobbing), and Gear Cutting Machines, Worm and Worm Wheels.

HOBS
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Shear Speed Chem. Prod. Div., Michigan Tool Co., 7125 E. McNichols Rd., Detroit 12, Mich.
Union Twist Drill Co., Athol, Mass.

HOIST HOOKS
Bethlehem Steel Co., Bethlehem, Pa.

HOISTING AND CONVEYING EQUIPMENT
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.

HOISTS, Air
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

HOISTS, Chain, Etc.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

HOISTS, Electric
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

HONES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Moline Tool Co., 102 20th St., Moline, Ill.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Sunnen Products Co. (Internal & External), 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, Internal (Cylinder)
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HONING MACHINES, External
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.

HONING TOOLS AND FIXTURES
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Sunnen Products Co., 7900 Manchester Ave., St. Louis 17, Mo.

HOSE, Leather, Rubber, Metallic, Etc.
American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

HYDRAULIC MACHINERY, Tools and Equipment
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati Ohio.

(*Continued on page 350*)

WHERE PLATE IS WELDED

A STEELWELD IS NEEDED . . .

Whether you make boilers, furniture, railroad cars, ships, airplanes or machinery, if you work with metal from 12 gauge to one inch thick, most likely you have great need for a Steelweld Bending Press.

Steelwelds are versatile tools that perform many types of work quickly and easily, whether only one piece or a production run is required. Long, sharp welded corners can be replaced by quickly made, smooth, round, bended ones, and both appearance and strength improved. Illustrated below are some of the many kinds of work that can be performed on any Steelweld.

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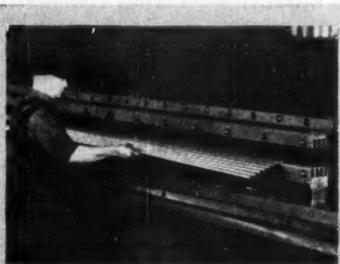
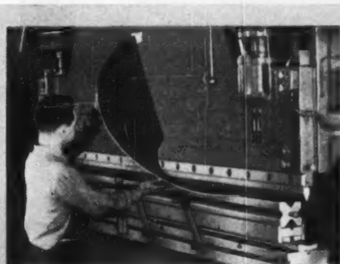


Corrugating and any straight-line production bending can be done to hairline accuracy.



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Bethlehem Steel Corp., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg Co., Chambersburg, Pa.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hydraulic Press Mfg., Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div., H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

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Bellows Co., 230 W. Market St., Akron, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, John S., Corp., Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Rivett Lathe & Grinder, Inc., Brighton, Boston, 35, Mass.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.

INDEXING AND SPACING EQUIPMENT

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Brown & Sharpe Mfg. Co., Providence, R. I.
Engis Equipment Co., 431 S. Dearborn St., Chicago 5, Ill
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Zagar Tool, Inc., 24000 Lakeland Blvd., Cleveland 23, Ohio.

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Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
DoAll Co, 254 Laurel Ave., Des Plaines, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

INDICATORS, Speed

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

INDICATORS, Test

Ames, B. C., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Standard Gage Co., Inc., Poughkeepsie, N. Y.
Starrett, The L. S., Co., Athol, Mass.

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Ohio Crankshaft Co., 3800 Harvard Ave., Cleveland, Ohio.

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Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

JACKS, Planer

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Northwestern Tool & Engrg. Co., 117 Hollier Dayton, Ohio.

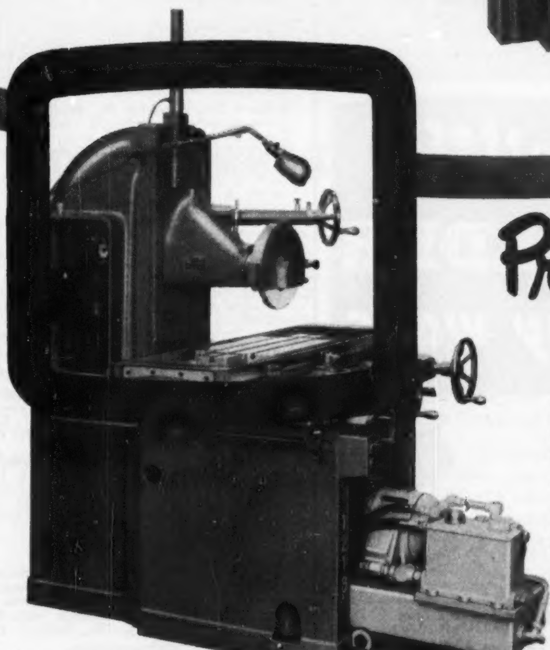
JIG BORER

See Boring Machines, Jig.

JIGS AND FIXTURES

Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Columbus Die, Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Ingersoll Milling Machine Co., 2442 Douglas St., Rockford, Ill.
John, B., Manufacturing Co., Ellis St., New Britain, Conn.

(*Continued on page 352*)



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Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Woodworth, N. A., Co., 1300 E Nine Mile Rd., Detroit 20, Mich.

JOINTS

See Fittings, Hydraulic, Pneumatic, Etc.

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Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Co., Rochester, N. Y.
Davis Keyseater Co., 405 Exchange St., Rochester 8, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Mitts & Merrill, 68 Holden St., Saginaw, Mich.

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Pratt & Whitney, West Hartford 1, Conn.

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Pratt & Whitney, West Hartford 1, Conn.

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Barnes Drill Co. (Straight Line or Rotating), 814 Chestnut St., Rockford, Ill.
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Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill. (Lapmaster Div.).
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Micromatic Hone Corp., 8100 Schoolcraft, Detroit 4, Mich.
Norton Co., 1 New Bond St., Worcester 6, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

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Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.

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Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

LATHE ATTACHMENTS

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hendey Machine Co., Inc., Torrington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sidney Machine Tool Co., Sidney, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

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Master Mfg. Co., Hutchinson, Kansas.

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Bullard Co., Brewster St., Bridgeport 2, Conn.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Goss & DeLeeuw Mch. Co., Kensington, Conn.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Porter-Cable Machine Co., Salina St., Syracuse N. Y.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
Pratt & Whitney, West Hartford 1, Conn.
Russell, Holbrook & Henderson, Inc., 292 Madison Ave., New York 17, N. Y.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Axle

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Bench

Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.

(*Continued on page 354*)

Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

LATHES, Boring

Bullard Co., Brewster St., Bridgeport 2, Conn.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.

LATHES, Crankshaft

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Double-End

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

LATHES, Duplicating

H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Sidney Machine Tool Co., Sidney, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.

LATHES, Engine and Toolroom

American Tool Works Co., Pearl and Eggleston Aves., Cincinnati, Ohio.
Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
Cincinnati Lathe & Tool Co., 3207-3211 Disney St., Oakley, Cincinnati 9, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
Hendey Machine Co., Inc., Torrington, Conn.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Logan Engrg. Co., 4901 W. Lawrence Ave., Chicago 30, Ill.
Monarch Machine Tool Co., 27 Oak St., Sidney, Ohio.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Sidney Machine Tool Corp., Sidney, Ohio.
Simmons Machine Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.

LATHES, Gap

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
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H.E.B. Machine Tools, Inc., 475 Fifth Ave., New York 17, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Nebel Machine Tool Co., 3401 Central Parkway, Cincinnati 25, Ohio.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Sidney Machine Tool Corp., Sidney, Ohio.
Springfield Mch. Tool Co., Springfield, Ohio.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Gun

Consolidated Mch. Tool Corp., Rochester, N. Y.
LeBlond, R. K., Mch. Tool Co., Madison and Edwards Rds., Cincinnati 18, Ohio.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Seneca Falls Mch. Co., Seneca Falls, N. Y.

LATHES, Hollow Spindle

Axelson Mfg. Co., P. O. Box 15335, Vernon Sta., Los Angeles 58, Calif.
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Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.

LATHES, Spinning

Bliss, E. W., Co., 1375 Raff Rd., S. W. Canton, Ohio.
Ferracute Machine Co., Bridgeton, N. J.

LATHES, Toolroom

See Lathes, Engine and Toolroom.

LATHES, Turret

Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.

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Bullard Co., Brewster St., Bridgeport 2, Conn.
Casa Corp., 405 Lexington Ave., New York 17, N. Y.
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Hardinge Brothers, Inc. (Bench or Cabinet Mounting), 1418 College Ave., Elmira, N. Y.
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Lodge & Shipley Co., 3055 Colerain Ave., Cincinnati 25, Ohio.
Millholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Potter & Johnston Co. (Automatic), 1027 Newport Ave., Pawtucket, R. I.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
South Bend Lathe Works, 425 E. Madison St., South Bend, Ind.
Springfield Mch. Tool Co., Springfield, Ohio.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

LATHES, Vertical Turret

American Steel Foundries, King Mch Tool Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.

LAYOUT FLUID

Dykem Co., 2303 P. North 11th St., St. Louis 6, Mo.

LEVELS

Bullard Co., Brewster St., Bridgeport 2, Conn.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

LOCKNUTS

Link-Belt Co. (For Positioning Bearings), 519 N. Holmes Ave., Indianapolis 6, Ind.

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Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Lubriplate Div., Fiske Bros. Refining Co., 129 Lockwood St., Newark 5, N. J.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart, D. A., Oil Co., Ltd., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

LUBRICATING SYSTEMS

Farval Corp., 3249 E. 80th St., Cleveland, Ohio.
Madison-Kipp Corp., Madison, Wis.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.

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See Calipers, Hammers, Wrenches, Drills, Taps, Etc.

MANDRELS

See Arbors and Mandrels.

MARKING MACHINES AND DEVICES

Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.

MEASURING MACHINES AND INSTRUMENTS, Precision

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Federal Products Corp., P. O. Box 1027, Providence, R. I.
Homestrand, Inc., Larchmont, N. Y.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

MEASURING WIRES, THREAD, SPLINE AND GEAR

Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

METAL, Bearings

See Bearings, Bronze, Babbitt, Etc., and Bushings, Brass, Bronze, Etc.

METERS

See Recording Instruments.

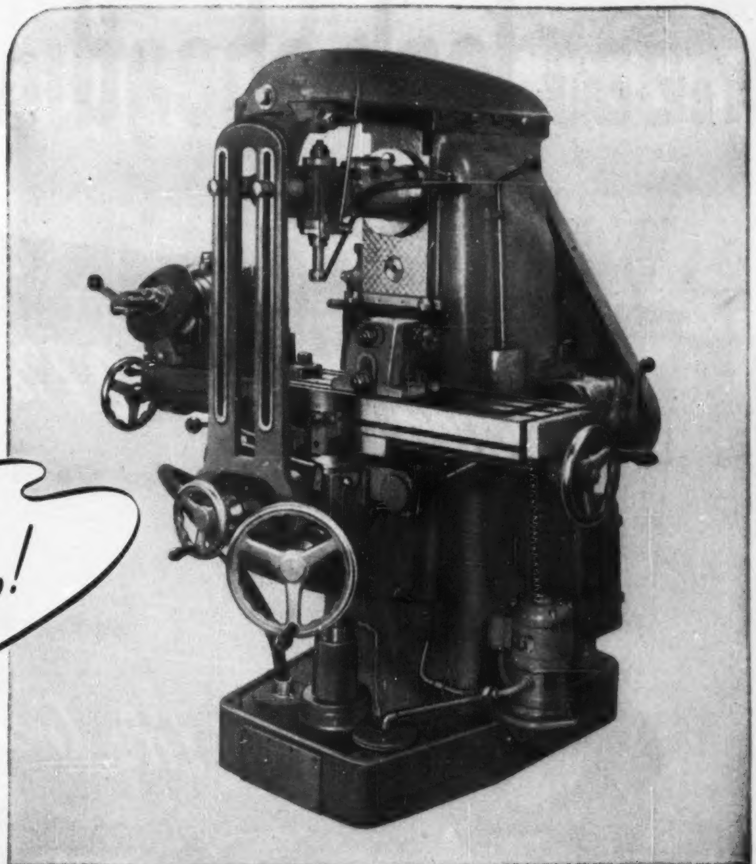
MICROMETERS

Ames, B. C., Co. (Dial), Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.

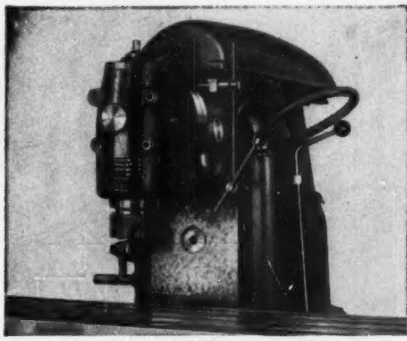
MICROSCOPES, Toolmakers

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

(Continued on page 360)



Swedish Craftsmanship!



Sajo Vertical Milling Attachment

The Sajo "Plain" Milling Machine

the SAJO "UNIVERSAL" MILLING MACHINE

exemplifies the expert workmanship that is traditional in Swedish machine tools. Like all SAJO Millers, this new Universal Milling Machine was designed and built to the highest standards of quality and practical utility.

Avoidance of exterior "luxury" features, slight in value but substantial in cost, and concentration on the vital factors of construction, enable the SAJO to deliver top performance at moderate cost.

SAJO Millers are available in Plain and Universal types, with longitudinal power table feed only, or with power feed in all directions. Screws and dials are in the U. S. inch system.

★ **Standard Equipment includes:** 3 HP motor and starter equipment, motor driven coolant system, adjustable table feed nut to allow climb-milling, 1" arbor, arbor support brace.

★ **Extra Equipment:** Universal Dividing Head, Vertical Milling Attachment, Slotting Attachment, Swivel Base Vise, Rotary Table.

CONDENSED SPECIFICATIONS

Table Size	41⅛" x 9¼"
Longitudinal travel: Plain Miller	24½"
Universal Miller	27½"
Transverse travel	8¼"
Vertical travel	19"
12 spindle speeds	36-1540 RPM
Table feeds	12
Taper in spindle	No. 40 NMT
Main motor	3 HP

Precision anti-friction bearings on spindle and gear shafts
One-piece column and base
Net weight—2200 lbs.

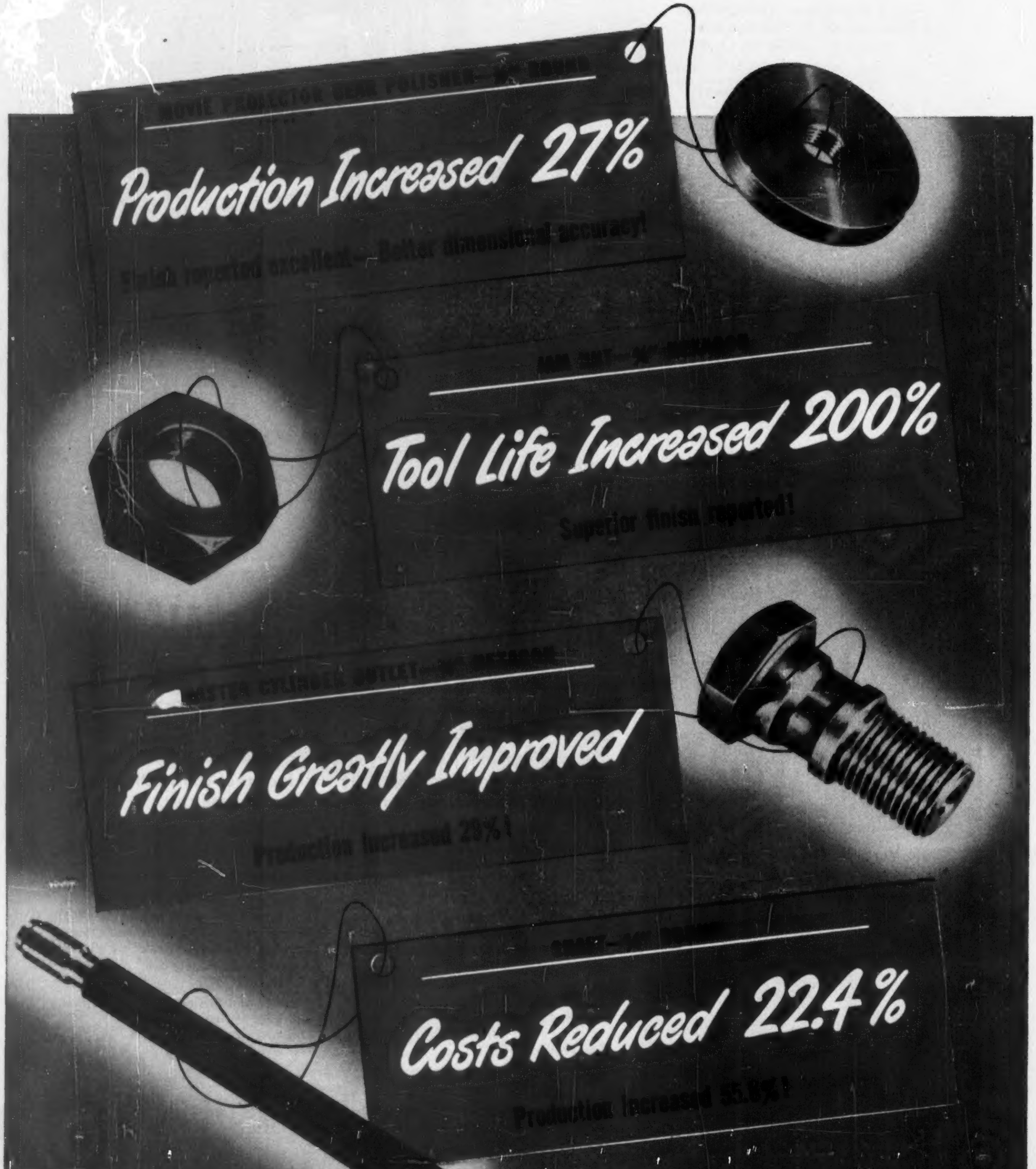
Write for Catalog

NO PRIORITY—— PROMPT DELIVERY——ATTRACTIVE PRICE

AUSTIN INDUSTRIAL CORP. 76-E MAMARONECK AVE. WHITE PLAINS, N. Y.

DEALERS IN PRINCIPAL CITIES

You can look ahead with confidence



MILLING ATTACHMENTS

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Van Keuren Co., 176 Waltham St., Watertown, Boston, Mass.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING AND CENTERING MACHINES

Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Jones & Lamson Mch. Co. (Automatic), 160 Clinton St., Springfield, Vt.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Automatic

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jones & Lamson Mch. Co., 160 Clinton St., Springfield, Vt.
Kearney & Trecker Corp., Milwaukee, Wis.
New England Mch. & Tl. Co., (Electronic) Berlin, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Bench

Hardinge Bros., Inc. (Bench or Pedestal Type), 1418 College Ave., Elmira, N. Y.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Circular Continuous

Consolidated Machine Tool Corp., Rochester, N. Y.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Duplex

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

MILLING MACHINES, Hand

Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Nichols-Morris Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Horizontal, Plain and Universal

Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Machine Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17.
Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Greaves Mch. Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Kempsmith Machine Co., 1819 S. 71st St., Milwaukee 14, Wis.
Marac Mchry. Corp., 1819 Broadway, New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sheldon Machine Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Lincoln Type

Brown & Sharpe Mfg. Co., Providence, R. I.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Planer Type

Consolidated Mch. Tool Corp., Rochester, N. Y.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn. R. R. Evanston, Cincinnati, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Pratt & Whitney, West Hartford 1, Conn.

MILLING MACHINES, Planetary Type

Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.

MILLING MACHINES, Profile

Cincinnati Milling Machine Co., Cincinnati, Ohio.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Groton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

MILLING MACHINES, Ram Type Universal

Fray Machine Tool Co., 515 W. Windsor Rd., Glendale 4, Calif.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

MILLING MACHINES, Turret Type

Bridgeport Machines, Inc., Linley Ave., Bridgeport, Conn.

MILLING MACHINES, Vertical

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Milling Machine Co., Cincinnati, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ekstrom, Carlson & Co., 1437 Railroad Ave., Rockford, Ill.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Kearney & Trecker Corp., Milwaukee, Wis.
Marac Mchry. Co., 1819 Broadway, New York, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sunstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MODEL AND EXPERIMENTAL WORK

See Special Machinery and Tools.

MOLD AND DIE COPYING MACHINES

Cosa Corp., 405 Lexington Ave., New York 17.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Pratt & Whitney, West Hartford 1, Conn.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

MOLDING MACHINES, Plastic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford. Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

MOTORS, Electric

Delco Products Div., General Motors Corp., 321 E. First St., Dayton, Ohio.
General Electric Co., Schenectady, N. Y.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

MOTORS, Hydraulic

Gerotor May Corp., Oliver St. and Maryland Ave., Baltimore, Md.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

MULTIPLE-SLIDE FORMING MACHINES

Nilson Machine Co., A. H., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

NIBBLING MACHINES

Campbell Machine Div., American Chain & Cable Co., Inc., 929 Connecticut Ave., Bridgeport, Conn.

NIBBLING MACHINES, Nickel

International Nickel Co., Inc., 67 Wall St., New York, N. Y.

NIPPLE THREADING MACHINERY

Landis Machine Co., Inc., Waynesboro, Pa.

NUT MAKING MACHINERY

National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

NUMBERING MACHINES

Numberall Stamp & Tool Co., Staten Island, N. Y.

NUT SETTING EQUIPMENT

See Screw Driving and Nut Setting Equipment.

NUT TAPPERS

See Bolt and Nut Machinery.

NUTS, Cold Forged, Wing and Cap

Chicago Screw Co., Bellwood, Ill.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp. (Union Drawn Steel Div.), Republic Bldg., Cleveland 1, Ohio.
Union Drawn Steel Co. Div., Republic Steel Corp., Massillon, Ohio.

NUTS, Self-Locking

Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.
Grip Nut Co., 310 S. Michigan Ave., Chicago 4,

(*Continued on page* 362)

NUTS, Thumb or Wing and Cap

Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Republic Steel Corp., Bolt and Nut Div., Republic Bldg., Cleveland 1, Ohio.

OIL CUPS

Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL EXTRACTORS AND CLEANERS

De Laval Separator Co., Poughkeepsie, N. Y.

OIL GROOVERS

Wicaco Machine Co., Stenton Ave. and Louden St., Philadelphia, Pa.

OIL-HOLE COVERS

Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

OIL SEALS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.

OILERS AND LUBRICATORS

Bellows Co., 230 W. Market St., Akron, Ohio.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.
Madison-Kipp Corp., Madison, Wis.

OILS, Cutting

See Cutting and Grinding Fluids.

OILS, Lubricating

Cities Service Oil Co., 70 Pine St., New York, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.
Sun Oil Co., 1608 Walnut St., Philadelphia, Pa.
Texas Co., 135 E. 42nd St., New York, N. Y.
Tide Water Associated Oil Co., 17 Battery Place, New York, N. Y.

OILS, Quenching and Tempering

Cities Service Oil Co., 70 Pine St., New York, N. Y.
Gulf Oil Corp., Gulf Bldg., Pittsburgh 30, Pa.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Sinclair Refining Co., 630 5th Ave., New York, N. Y.
Standard Oil Co. (Indiana), 910 S. Michigan, Chicago, Ill.
Stuart Oil Co., Ltd., D. A., 2739 S. Troy St., Chicago 23, Ill.

OILS, Soluble

See Compounds, Cutting, Grinding, Metal Drawing, Etc.

OPTICAL FLATS

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.

ORDNANCE MACHINES, Special

Rehnberg-Jacobson Mfg. Co., 2135 Kishwaukee St., Rockford, Ill.

PACKING, Leather, Metal, Rubber, Asbestos, Etc.

Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Houghton & Co., E. F., 303 W. Lehigh Ave., Philadelphia, Pa.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PARALLELS

Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Walker, O. S., Co., Inc., Worcester, Mass.

PATTERNS, Wood and Metal

Mummert-Dixon Co., Hanover, Pa.

PHOSPHOR BRONZE
See Bronze

PILLOW BLOCKS
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
C & C Sales Corp., 1771 Broadway, New York 19, N. Y.
Link-Belt Co., 519 N. Holmes Ave., Indianapolis 6, Ind.
Norma-Hoffmann Bearings Corp., Stamford, Conn.
Shafer Bearing Corp., Downers Grove, Ill.
S K F Industries, Inc., P. O. Box 6731, North Philadelphia, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.

PIPE, BRASS AND COPPER
American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

PIPE STEEL
Alleghany Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
United States Steel Corp., National Tube Co., Div., 436 7th Ave., Pittsburgh, Pa.

PIPE THREADING AND CUTTING MACHINES
Landis Machine Co., Inc., Waynesboro, Pa.

PIPE TONGS
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

PLANER ATTACHMENTS
Consolidated Mch. Tool Corp., Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.

PLANERS, Double Housing and Openside
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio (Plate).
Consolidated Mch. Tool Corp. (Incl. Plate, Rotary and Crank Types), Rochester, N. Y.
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Gray, G. A., Co., Woodburn Ave. and Penn R. R., Evanston, Cincinnati, Ohio.
Rockford Machine Tool Co., 2500 Kishwaukee St., Rockford, Ill.

PLASTIC AND PLASTIC PRODUCTS
Bakelite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York 17, N. Y.

PLATE ROLLS
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E. Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

PLATES, Surface
Brown & Sharpe Mfg. Co., Providence, R. I.
Brush Electronics Co., 3405 Perkins Ave., Cleveland 14, Ohio.
Challenge Machinery Co., Grand Haven, Mich.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Pratt & Whitney Div., West Hartford 1, Conn.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.

(*Continued on page 364*)

PNEUMATIC EQUIPMENT

Bellows Co., 230 W. Market St., Akron, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Thor Power Tool Co., Aurora, Ill.

POLISHING LATHES AND MACHINES

Black & Decker Mfg. Co., Penna. Ave., Towson, Md.
Gardner Machine Co. (Div. Landis Tool Co.), 414 E. Gardner St., Beloit, Wis.
Hammond Machinery Builders, Inc., 1600 Douglas Ave., Kalamazoo 54, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Millers Falls Co., Greenfield, Mass.
Standard Electrical Tool Co., 2488-90 River Rd., Cincinnati 4, Ohio.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POLISHING TOOLS, Portable

Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Jarvis, Charles L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.

POWER UNITS, Hydraulic

See Hydraulic Power Units or Tool Heads.

PRESSES, Air

Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.

PRESSES, Arbor

Bellows Co., 230 W. Market St., Akron, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Tomkins-Johnson Co., 614 No. Mechanic St., Jackson, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PRESSES, Broaching

American Broach & Mch. Co., Ann Arbor, Mich.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Colonial Broach Co., Detroit 13, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Die Tryout

Alpha Tool Works, 9281 Freeland Ave., Detroit 28, Mich.

PRESSES, Extrusion

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Co., Kenmore Station, Buffalo, N. Y.

(Continued on page 366)


Re-check YOUR
Cost Relief Zone!

Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PRESSES, Foot

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

PRESSES, Forging

Ajax Mfg. Co., Euclid, Cleveland 17, Ohio.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Erie Foundry Co., Erie, Pa.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morgan Engrg. Co., Alliance, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Hydraulic

American Broach & Mch. Co., Ann Arbor, Mich.
American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Birdsboro Steel Fdry. & Mch. Co., Birdsboro, Pa.
Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Clifton Hydraulic Press Co., Clifton, N. J.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Erie Foundry Co., Erie, Pa.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

PRESSES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

PRESSES, Screw

Bliss Co., E. W., 1375 Raff Rd., S. W., Canton, Ohio.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Ferracute Machine Co., Bridgeton, N. J.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.

PRESSES, Sheet Metal Working

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Bliss Co., E. W., 1375 Raff Rd., S. W. Canton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Clearing Machine Corp., 6499 W. 65th St., Chicago 38, Ill.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Danly Machine Specialties, Inc., 2107 S. 52nd Ave., Chicago 50, Ill.
Dreis & Krump Mfg. Co., 7416 Loomis Blvd., Chicago 36, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Henry & Wright Div., Emhart Mfg. Co., 760 Windsor St., Hartford 1, Conn.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Johnson Mch. & Press Corp., 620 W. Indiana Ave., Elkart, Ind.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
L & J Press Corp., Elkhart, Ind.
Minster Machine Co., Minster, Ohio.
Niagara Machine & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Sales Service Mch. Tool Co., 2363 University Ave., St. Paul, Minn.
Verson Allsteel Press Co., 93rd St. and S. Kenwood Ave., Chicago, Ill.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.
Walsh Press & Die Co., 4727 W. Kinzie St., Chicago 44, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.
Zeh & Hahnemann Co., 182 Vanderpool St., Newark, N. J.

PRESSES, Straightening

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.
Baldwin-Lima-Hamilton Corp., Lima-Hamilton Div., Hamilton, Ohio.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., P. O. Box 37, Harper Sta., Detroit, Mich.
Consolidated Mch Tool Corp., Rochester, N. Y.
Dake Engine Co., 604 Seventh St., Grand Haven, Mich.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hufford Machine Works, Inc, 1700 E. Grand Ave., El Segundo, Calif.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works (Hydraulic), 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wilson, K. R., 215 Main St., Buffalo, N. Y.

PROFILING MACHINES

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gorton, George, Machine Co., 1110 W. 13th St., Racine, Wis.
Morey Mchry. Co., Inc. (and affiliated companies), 410 Broome St., New York, N. Y.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Pines Engineering Co., Inc., Aurora, Ill.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

PULLEYS

Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

PULLEYS, Friction Clutch

Brown & Sharpe Mfg. Co., Providence, R. I

PUMPS, Coolant, Lubricant and Oil

Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 620 E. Vienna Ave., Milwaukee, Wis.
Ingersoll-Rand Co., Phillipsburg, N. J.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Ruthman Machinery Co., 1809 Reading Rd., Cincinnati 12, Ohio.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Tompkins-Johnson Co., Jackson, Mich.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

PUMPS, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Brown & Sharpe Mfg. Co., Providence, R. I.
Chambersburg Engrg. Co., Chambersburg, Pa.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Gerotor May Corp., Oliver St. and Maryland Ave. Baltimore, Md.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll-Rand Co., Phillipsburg, N. J.
Lapointe Machine Tool Co., 34 Tower St., Hudson, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.
Vinco Corp., 9113 Schaefer Highway, Detroit 28, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

PUMPS, Pneumatic

Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Thor Power Tool Co., Aurora, Ill.

PUMPS, Rotary

Brown & Sharpe Mfg. Co., Providence, R. I.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Sier-Bath Gear & Pump Co., Inc., 9248 Hudson Blvd., North Bergen, N. J.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.
Tuthill Pump Co., 939 E. 95th St., Chicago 19, Ill.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Viking Pump Co., Cedar Falls, Iowa.

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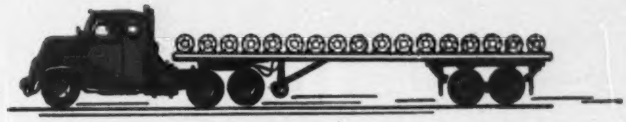

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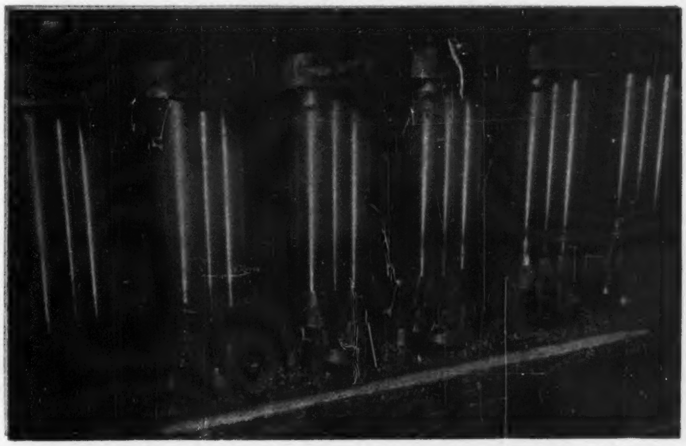
TONS OF PRODUCTION!



ACTUAL JOB

Farm Implement Mfg. Co.

Machine........Ingersoll Boring Mill—6 spindle
Part...........Cylinder block
Operation.......Rough cylinder bore
Tools..........3 R.H. and 3 L.H. Wesson Fine Pitch Cutters—3.480 dia.—12 Wessonmetal Solid GI Blades
Speed..........148 S.F.M.
Stock Removel...3/16″
Feed...........10″ per min.—.063 per revolution
Length of Cut....8⅞″

OVER 300% DOLLAR SAVINGS PER TOOL

OLD METHOD		NEW WESSON METHOD	
Pieces per Grind	836	Pieces per Grind	3160
Cost of Tool	$49.68	Cost of Tool	$172.80
Grinding Cost per sharpening	$11.70	Grinding Cost per Sharpening	$8.78
Tool Cost per 100 Pieces	$2.588	Tool Cost per 100 Pieces	$0.642

On only one machine with Wesson Tools Savings of over $900 per year

HOW IS YOUR PRODUCTION SCORE CARD!

Write today for folder on Wesson's educational, full color, sound movie—"This Carbide Age."

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LEXINGTON, KENTUCKY
Affiliated with WESSON COMPANY, Detroit, Mich.

PUNCHES AND DIES
See Dies, Sheet Metal, Etc.

PUNCHES, Centering
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.

PUNCHING MACHINERY
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg. Co., Lake City, Minn.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wiedemann Machine Co., 4272 Wissahickon Ave., Philadelphia, Pa.

RACKS, Gear Cut
Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gear Specialties, Inc., 2635 W. Medill Ave., Chicago 47, Ill.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
James, D. O., Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Massachusetts Gear & Tool Co., 36 Nassau St., Woburn, Mass.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

REAMER HOLDERS
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Warner & Swasey Co., 8701 Carnegie Ave., Cleveland 3, Ohio.

REAMERS
Atrax Co., Newington, Conn.
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 27, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Keo Cutters, 19326 Woodward, Detroit, Mich.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

REAMERS, Adjustable
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Union Twist Drill Co., Athol, Mass.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMERS, Taper Pin
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenfield Tap & Die Corp., Greenfield, Mass.
Kaufman Manufacturing Co., Manitowoc, Wis.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.

REAMING MACHINES
Barnes Drill Co., 814 Chestnut St., Rockford, Ill.
Greaves Machine Tool Co., 2009 Eastern Ave., Cincinnati, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Van Norman Co., 3640 Main St., Springfield 7, Mass.

RECORDING INSTRUMENTS for Counting
National Acme Co., 170 E. 131st St., Cleveland, Ohio.

RECTIFIERS
Federal Telephone & Radio Corp.

REELS, Stock, Standard and Automatic
Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

REFRACTORIES, Heat-Treating Furnace
Norton Co., 1 New Bond St., Worcester 6, Mass.

REGULATORS, Temperature
Air Conversion Research Corp., 4107 N. Damen Ave., Chicago 18, Ill.
General Electric Co., Schenectady, N. Y.

REMOVERS, Japan, Enamel, Etc.
Oakite Products, Inc., 19 Rector St., New York, N. Y.

RETAINING RINGS FOR BEARINGS, Etc.
Nice Ball Bearing Co., Nicetown, Philadelphia, Pa.
Waldes-Kohinoor, Inc., 4716 Austel Place, Long Island City 1, N. Y.

RHEOSTATS
Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
General Electric Co., Schenectady, N. Y.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

RIVET SETS
Bethlehem Steel Co., Bethlehem, Pa.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Peck, Stow & Wilcox Co., Southington, Conn.
Thor Power Tool Co., Aurora, Ill.

RIVETERS, Hydraulic
Bethlehem Steel Co., Bethlehem, Pa.
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Hanna Engineering Works, 1752 Elston Ave., Chicago, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

RIVETERS, Pneumatic
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.

RIVETING MACHINES
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Grant Mfg. & Machine Co., 90 Silliman St., Bridgeport 5, Conn.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Tomkins-Johnson Co., Jackson, Mich.

RIVET MAKING MACHINES
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.

RUBBER PRODUCTS
Garlock Packing Co., Palmyra, N. Y.

RULES, Steel
Brown & Sharpe Mfg. Co., Providence, R. I.
Lufkin Rule Co., Hess Ave., Saginaw, Mich.
Millers Falls Co., Greenfield, Mass.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.

RUST PREVENTIVES
Houghton, E. F., & Co., 303 W. Lehigh Ave., Philadelphia, Pa.
Oakite Products, Inc., 19 Rector St., New York, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAND BLAST EQUIPMENT
See Blast Cleaning Equipment.

SANDERS
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Chicago Pneumatic Tool Co., 6 E 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Millers Falls Co., Greenfield, Mass.
Sundstrand Machine Tool Co., 2531 11th St., Rockford, Ill.
Thor Power Tool Co., Aurora, Ill.

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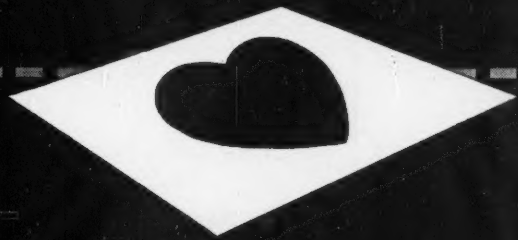
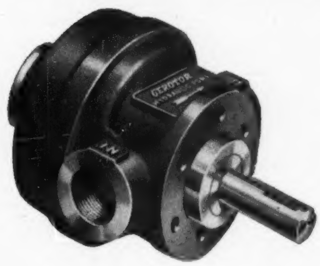
"stout heart" of any hydraulic circuit



GEROTOR hydraulic pumps



Series "B" Hydraulic Pumps . . . 3 sizes, for continuous pressures up to 1000 p.s.i. Deliveries from .4 to 1.5 g.p.m. at 1800 r.p.m.

Series "QH" Hydraulic Pumps . . . 4 sizes, for continuous pressures up to 1200 p.s.i., intermittent to 1500. Deliveries from 3 to 12 g.p.m. at 1200 r.p.m.

Series "O" Hydraulic Pumps . . . 4 sizes, for continuous pressures up to 1000 p.s.i. Deliveries from 20 to 40 g.p.m. at 1200 r.p.m.

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Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Millers Falls Co., Greenfield, Mass.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Victor Saw Works, Inc., Middletown, N. Y.

SAW SHARPENING MACHINES

Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
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Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.

SAWING MACHINES, Circular

Consolidated Mch. Tool Corp., Rochester, N. Y.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.

SAWING MACHINES, Friction

DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.

SAWING MACHINES, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plains, Ill.
Famco Machine Co., 3134 Sheridan Rd., Kenosha, Wis.
Grob Bros., Grafton, Wis.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., South Ave., Plainfield, N. J.

SAWING MACHINES, Power Hack

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Thor Power Tool Co., Aurora, Ill.
Victor Saw Works, Inc., Middletown, N. Y.

SAWS, Circular Metal Cutting

Alina Corp., 401 Broadway, New York 13, N. Y. (Portable.)
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Brown & Sharpe Mfg. Co., Providence, R. I.
Consolidated Mch. Tool Corp., Rochester, N. Y.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Espen-Lucas Machine Works, Front St. and Girard Ave., Philadelphia, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Twist Drill & Tool Co., & Winter Bros., & Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Triplex Machine Tool Corp., 75 West St., New York 6, N. Y.
Union Twist Drill Co., Athol, Mass.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Metal Cutting Band

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Atkins Saw Div., Borg-Warner Corp., 402 South Illinois St., Indianapolis 9, Ind.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Ryerson, Joseph T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

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Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Tannewitz Works, 315 Front St., N. W., Grand Rapids 2, Mich.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

SAWS, Portable Electric
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Millers Falls Co., Greenfield, Ohio.

SAWS, Screw Slotting
Barber-Colman Co., Rock and Montague, Rockford, Ill.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., & Winter Bros. Co., Rochester, Mich.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Starrett, The L. S., Co., Athol, Mass.
Union Twist Drill Co., Athol, Mass.

SCRAPERS, Hand and Power
Anderson Bros. Mfg. Co., 1910 Kishwaukee St., Rockford, Ill.

SCREW DRIVERS, Power
Chicago Pneumatic Tool Co., 6 E. 44th St., New York, N. Y.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Ingersoll-Rand Co., Phillipsburg, N. J.
Keller Tool Co., Grand Haven, Mich.

SCREW DRIVING AND NUT SETTING EQUIPMENT
Black & Decker Mfg. Co., E. Penna. Ave., Towson, Md.
Cleco Div., Reed Roller Bit Co., 5125 Clinton Ave., Houston 20, Texas.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ingersoll-Rand Co., Phillipsburg, N. J.
Jarvis, Charles L., Co., Middletown, Conn.
Keller Tool Co., Grand Haven, Mich.
Thor Power Tool Co., Aurora, Ill.

SCREW MACHINE TOOLS AND EQUIPMENT
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Millers Falls Co., Greenfield, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Potter & Johnston Co., 1027 Newport Ave., Pawtucket, R. I.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINE WORK
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Eastern Mch. Screw Corp., New Haven, Conn.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Acme Co., 170 E. 131st St., Cleveland.
Ottemiller, W. H., Co., York, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.

SCREW MACHINES, Automatic
Single and Multiple Spindle
Brown & Sharpe Mfg. Co., Providence, R. I.
Cone Automatic Mch. Co., Inc., Windsor, Vt.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Gorton, George, Mch. Co., 1110 W. 13th St., Racine, Wis.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hirschmann, Carl, Co., 30 Park Ave., Manhasset, N. Y.
National Acme Co., 170 E. 131st St., Cleveland.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW MACHINES, Hand
See also Lathes, Turret
Bardons & Oliver, Inc., Ft. W. 9th St., Cleveland 13, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Hardinge Bros., Inc., 1418 College Ave., Elmira, N. Y.
Orban, Kurt, Co., Inc., 205 East 42nd St., New York 17, N. Y.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.

SCREW PLATES
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Winter Bros. Co., Rochester, Mich.

SCREWS, Cap, Set, Safety Set and Machine, Etc.
Allen Mfg. Co., 133 Sheldon St., Hartford 2, Conn.
Allied Products Corp., 12677 Burt Rd., Detroit 23, Mich.
Chicago Screw Co., Bellwood, Ill.
National Acme Co., 170 E. 131st St., Cleveland Ohio.
Ottemiller, W. H., Co., York, Pa.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Republic Steel Corp., Bolt & Nut Div., Republic Bldg., Cleveland 1, Ohio.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.
Set Screw & Mfg. Co., 35 Main St., Bartlett, Ill.
Standard Pressed Steel Co., Jenkintown, Pa.

SCREWS, Self-tapping, Drive
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.

SCREWS, Thumb
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
Parker-Kalon Corp., 200 Varick St., New York 14, N. Y.
Russell, Burdsall & Ward Bolt & Nut Co., 100 Midland Ave., Port Chester, N. Y.

SEALS AND RETAINERS, Oil or Grease
Crane Packing Co., 1800 Cuyler Ave., Chicago, Ill.
Garlock Packing Co., Palmyra, N. Y.
Gits Bros. Mfg. Co., 1846-62 Kilbourn Ave., Chicago, Ill.

SECOND-HAND MACHINERY, Etc.
Eastern Machinery Co., 1006 Tennessee Ave., Cincinnati 22, Ohio.
Miles Machinery Co., Box 770, Saginaw, Mich.
Morey Mchry. Co., Inc., 410 Broome St., New York, N. Y.
Simmons Mch. Tool Corp., 1600 N. Broadway, Albany, N. Y.

SEPARATORS, Centrifugal
De Laval Separator Co., Poughkeepsie, N. Y.

SEPARATORS, Oil or Coolant
Barnes Drill Co. (Magnetic), 814 Chestnut, Rockford, Ill.
National Acme Co., 170 E. 131st St., Cleveland Ohio.

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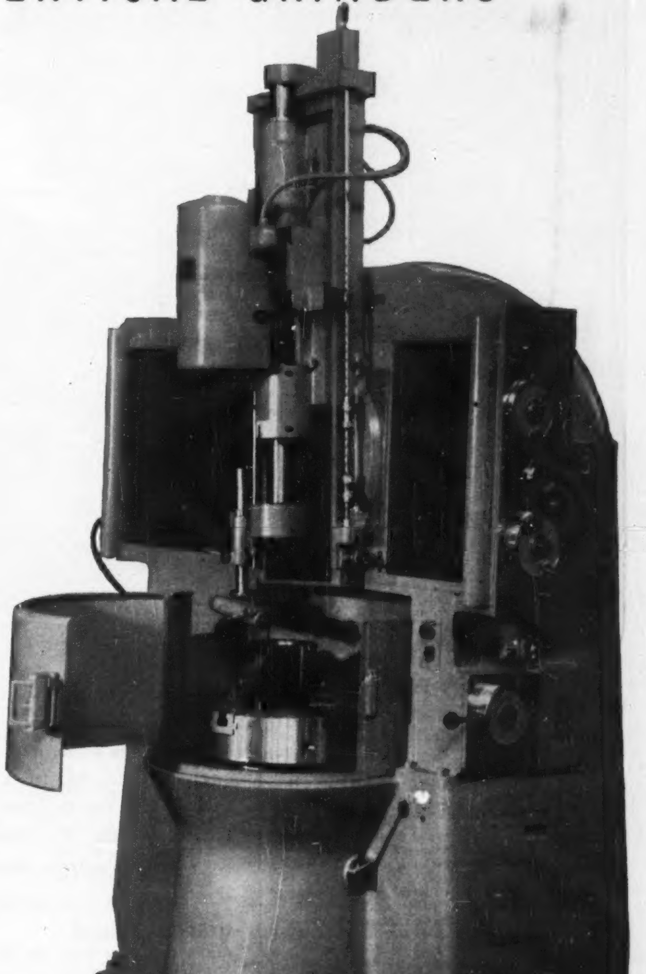

SHAFTING, Steel
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
De Laval Separator Co., Poughkeepsie, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS
National Forge & Ordance Co., Irvine, Warren County, Pa.
Standard Pressed Steel Co., Jenkintown, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAFTS, Flexible
Jarvis, Chas. L., Co., Middletown, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.

SHAFTS, Hollow-Bored
Bethlehem Steel Co., Bethlehem, Pa.

SHAFTS, Turned and Ground
Bethlehem Steel Co., Bethlehem, Pa.
Cumberland Steel Co., Cumberland, Md.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
National Forge & Ordance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Union Drawn Steel Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPER-PLANERS
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPERS
American Tool Works Co., Pearl and Eggleston Ave., Cincinnati, Ohio.
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hendey Machine Co., Inc., Torrington, Conn.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Orban, Kurt, Co., Inc., 205 E. 42nd St., New York 17, N. Y.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Sheldon Mch. Co., Inc., 4240-4258 N. Knox Ave., Chicago 41, Ill.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

SHAPERS, Vertical
Austin Industrial Corp., 76 Mamaroneck Ave., White Plains, N. Y.
Pratt & Whitney, West Hartford 1, Conn.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SHAPES, Cold Drawn Steel
Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

SHAPES, Structural
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEARING MACHINERY
Bethlehem Steel Co., Bethlehem, Pa.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Crane & Engrg. Co., Wickliffe, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Ferracute Machine Co., Bridgeton, N. J.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
O'Neil-Irwin Mfg., lake City, Minn.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Yoder Co., 550 Walworth Ave., Cleveland, Ohio.

SHEARS, Alligator
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.

SHEARS, Rotary
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co. (Knives), 470 Main St., Fitchburg, Mass.
Union Twist Drill Co., Athol, Mass.

SHEARS, Squaring
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Cleveland Punch & Shear Works Co., 3917 St. Clair Ave., N. E., Cleveland, Ohio.
Columbia Machinery & Engrg. Corp., Hamilton 1, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Famco Machine Co., 3134 Sheriden Rd., Kenosha, Wis.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Peck, Stow & Wilcox Co., Southington, Conn.
Simonds Saw & Steel Co. (Blades), 470 Main St., Fitchburg, Mass.

SHEET METALS
Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
American Brass Co., 25 Broadway, New York, N. Y.
Bethlehem Steel Corp., Bethlehem, Pa.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son., Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHEETS, Iron and Steel
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Corp., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc.. 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp., (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

SHIMS
Laminated Shim Co., Inc., Glenbrook, Conn.

SLEEVES
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.

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MIKRON *fine pitch*

- RACKS
- INTERNAL GEARS
- SEGMENTS
- CLUSTER GEARS

RACK & GEAR CUTTER No. 134—Another machine in the MIKRON line—*Controlled Accuracy, High Finish, Ease of Set-Up.*

THE precision cutter <u>shapes</u> as it <u>generates</u> tooth forms. The work meets your most exacting specifications and standards. Gear production requiring a shaping operation will be ideally performed with the MIKRON No. 134.

WORK PIECE CAPACITY

RACKS: (Straight or Skew) to 36″ long x 1″ wide.

SEGMENTS & CLUSTERS: to 3⅛″ dia. x 1″ wide.

INTERNAL GEARS: to 4″ dia. x 1″ wide.

RUSSELL, HOLBROOK & HENDERSON, INC.

292 Madison Avenue, New York 17, N. Y.

Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SLOTTING MACHINES

Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Lobdell United Co., 2000 "G" St., Wilmington 99, Del.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.

SOCKETS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Chicago-Latrobe Twist Drill Wks., 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist & Drill Mch. Co., New Bedford, Mass.
National Twist Drill & Tool Co., Rochester, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Union Twist Drill Co., Athol, Mass.

SPECIAL MACHINERY AND TOOLS

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati,
Baldwin-Lima-Hamilton Corp., Philadelphia 42,
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Bath, Cyril, Co., 6984 Machinery Ave., Cleveland 3, Ohio.
Boush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Bethlehem Steel Co., Bethlehem, Pa.
Bilgram Gear & Mch. Works, 1217-35 Spring Garden St., Philadelphia, Pa.
Birdsboro Steel Fdy. & Mch. Co., Birdsboro, Pa.
Blanchard Mch. Co., 64 State St., Cambridge, Mass.
Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
Chambersburg Engrg Co., Chambersburg, Pa.
Colonial Broach Co., Detroit 13, Mich.
Columbus Die-Tool & Mch. Co., 955 Cleveland Ave., Columbus, Ohio.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Douglas Tool Co., 2300 E. Nine Mile Rd., Hazel Park, Mich.
Espen-Lucas Mch. Works, Front St. and Girard Ave., Philadelphia, Pa.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Forney's Inc., P. O. Box N310, New Castle, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Gorton, Geo., Mch. Co., 1110 W. 13th St., Racine, Wis.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Ingersoll Milling Mch. Co., 2442 Douglas St., Rockford, Ill.
Jahn, B., Manufacturing Co., Ellis St., New Britain, Conn.
Kingsbury Mch. Tool Corp., Keene, N. H.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Lehmann Machine Co., 3560 Chouteau Ave., St. Louis, Mo.
Lipe-Rollway Corp., 806 Emerson Ave., Syracuse, N. Y.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Modern Industrial Engrg. Co., 14230 Birwood, Detroit 4, Mich.
Moline Tool Co., 102 20th St., Moline, Ill.
Morgan Engrg. Co., Alliance, Ohio.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Motch & Merryweather Mchry. Co., Penton Bldg., Cleveland, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
National Broach & Mch. Co., 5600 St. Jean Ave., Detroit 2, Mich.
National Tool Co., 11200 Madison Ave., Cleveland, Ohio.
National Twist Drill & Tool Co., Rochester, Mich.
New Britain Mch. Co., New Britain-Gridley Mch. Div., New Britain, Conn.
New England Mch. & Tl. Co., Berlin, Conn.
New Jersey Gear & Mfg. Co., 1470 Chestnut Ave., Hillside, N. J.
Niagara Mch. & Tool Works, 683 Northland Ave., Buffalo, N. Y.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Pioneer Engrg. & Mfg. Co., 19679 John R St., Detroit, Mich.
Pioneer Pump & Mfg. Co., 19679 John R St., Detroit, Mich.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Reed-Prentice Corp., 677 Cambridge St., Worcester, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Seneca Falls Mch. Co., Seneca Falls, N. Y.
Snyder Tool & Engrg. Co., 3400 E. Lafayette, Detroit 7, Mich.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Turner Bros., Inc., 2625 Hilton Rd., Ferndale 20, Mich.
Union Twist Drill Co., Athol, Mass.
Universal Engrg Co., Frankenmuth 2, Mich.
V & O Press Co., Div. Emhart Mfg Co., Hudson, N. Y.
Waltham Machine Works, Newton St., Waltham, Mass.
Wicaco Machine Corp., Stenton Ave. and Louden St., Philadelphia, Pa.
Zagar Tool Co., 24000 Lakeland Blvd., Cleveland 23, Ohio.

SPEED REDUCERS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Brad Foote Gear Works, 1309 S. Cicero Ave., Cicero 50, Ill.
Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gears, Div. Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Farrel-Birmingham Co., Inc., 25 Main St., Ansonia, Conn.
General Electric Co., Schenectady, N. Y.
James, D. O. Gear Mfg. Co., 1140 W. Monroe St., Chicago 7, Ill.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Perkins Mch. & Gear Co., Box 1611, Springfield 2, Mass.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Twin Disc Clutch Co., 1361 Racine St., Racine, Wis.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

SPINDLES, Grinding

Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Pope Mchry. Corp., Haverill, Mass.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

SPINNING LATHES

See Chucking Machines.

SPROCKET CHAINS

Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.

SPROCKETS

Amgears, Inc., 6633 W. 65th St., Chicago 38, Ill.
Atlantic Gear Works, Inc., 200 Lafayette St., New York 12, N. Y.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Link-Belt Co., 220 S. Belmont Ave., Indianapolis 6, Ind.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Inc., Erie Ave. and G St., Philadelphia, Pa.
Stahl Gear & Mch. Co., 3901 Hamilton Ave., Cleveland 14, Ohio.

STAMPINGS, All Metal

LaSalle Steel Co., Hammond, Ind.
Mullins Manufacturing Corp., Salem, Ohio.

STAMPINGS, Sheet Metal

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.
Laminated Shim Co., Inc., Glenbrook, Conn.
Mullins Manufacturing Corp., Salem, Ohio.
Republic Steel Corp., Niles Steel Products Div., Republic Bldg., Cleveland 1, Ohio.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

STAMPS, Steel and Marking Dies

Hoggson & Pettis Mfg. Co., 149 Brewery St., New Haven, Conn.
Numberall Stamp & Tool Co., Staten Island, N. Y.

STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Forge & Ordnance Co., Irvine, Warren County, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co., Div. Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.
U. S. Steel Supply Div., U. S. Steel Co., 208 S. LaSalle St., Chicago 4, Ill.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Cold Drawn

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Union Drawn Steel Div., Massillon, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, High Speed Tool

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 Armstrong Ave., Chicago, Ill.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.

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Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Machine

Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
LaSalle Steel Co., Hammond, Ind.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Stainless

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Timken Roller Bearing Co., Canton, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div.), 436 7th Ave., Pittsburgh, Pa.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

STEEL, Strip and Sheet

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
U. S. Steel Corp. (American Steel & Wire Co. Div., Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div.), 436 7th Ave., Pittsburgh, Pa.

STEEL, Tool and Die

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Carpenter Steel Co., Reading, Pa.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.

STEEL, Zinc, Tin and Copper Coated Strip

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.

STEEL ALLOYS

See Alloys, Steel.

STEEL BARS

See Bars, Steel.

STEEL STOCK GROUND FLAT

Brown & Sharpe Mfg. Co., Providence, R. I.
Starrett, The L. S., Co., Athol, Mass.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30, Pa.

STELLITE

Haynes Stellite Div., Union Carbide & Carbon Corp. (Alloy), 30 E. 42nd St., New York, N. Y.

STOCKS, Die

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

STONES, Oil or Sharpening

Bay State Abrasive Co., Westboro, Mass.
Carborundum Co., Buffalo Ave., Niagara Falls, N. Y.
Norton Co., 1 New Bond St., Worcester 6, Mass.

STOOLS

Standard Pressed Steel Co., Jenkintown, Pa.

STRAIGHTEDGES

Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

STRAIGHTENERS, Flat Stock and Wire

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

STRAIGHTENING MACHINERY

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Chambersburg Engrg. Co., Chambersburg, Pa.
Colonial Broach Co., Detroit 13, Mich.
Consolidated Mch. Tool Corp., Rochester, N. Y.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Lake Erie Engrg. Corp., Kenmore Station, Buffalo, N. Y.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4, Wis.
Springfield Mch. Tool Co., Springfield, Ohio.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.

STUD SETTERS

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.

SUB-PRESSES

Waltham Machine Works, Newton St., Waltham, Mass.

SUPERFINISHING MACHINES

Gisholt Machine Co., 1245 E. Washington Ave., Madison 10, Wis.

SURFACE PLATES

See Plates, Surface.

SWAGING MACHINES

Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Torrington Co., Torrington, Conn.

SWITCHES

Allen-Bradley Co., 1326 S. 2nd St., Milwaukee, Wis.
Central Products, Inc. (Waterproof and Thermo), 306 Sussex St., Harrison, N. J.
General Electric Co., Schenectady, N. Y.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

TACHOMETERS

Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Veeder-Root, Inc., 20 Sargent St., Hartford, Conn.

TAPER PINS, Standard

Chicago Screw Co., Bellwood, Ill.
Morse Twist Drill & Mch. Co., New Bedford, Conn.
Pratt & Whitney, West Hartford 1, Conn.

TAP HOLDERS

Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
McCrosky Tool Co., 1938 Thomas St., Meadville, Pa.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Scully-Jones & Co., 1903 Rockwell St., Chicago, 8, Ill.

TAPPING ATTACHMENTS AND DEVICES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Errington Mechanical Laboratory, Inc., 24 Norwood Ave., Stapleton, S. I., N. Y.
Ettco Tool Co., Inc., 592 Johnson Ave., Brooklyn, N. Y.
Homestrand, Inc., Larchmont, N. Y.
Jarvis, Chas. L., Co., Middletown, Conn.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Thriftmaster Products Corp., 1076 N. Plum St., Lancaster, Pa.

TAPPING MACHINES

Avey Drilling Mach. Co., 26 E. Third St., Covington, Ky.
Baker Bros., Inc., Station F, P. O. Box 101, Toledo 10, Ohio.
Barnes Drill Co., 814 Chestnut, Rockford, Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Baush Machine Tool Co., 156 Wason Ave., Springfield 7, Mass.
Bodine Corp., 317 Mt. Grove St., Bridgeport, Conn.
Buffalo Forge Co., 490 Broadway, Buffalo, N. Y.
Challenge Mchry. Co., Grand Haven, Mich.
Cleveland Tapping Machine Co., Canton 6, Ohio.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Hamilton Tool Co., 834 South 9th St., Hamilton, Ohio.
Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Jarvis, Chas. L., Co., Middletown, Conn.
Kaufman Manufacturing Co., Manitowoc, Wis.
Kingsbury Mch. Tool Corp., Keene, N. H.
Leland-Gifford Co., 1025 Southbridge St., Worcester, Mass.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Moline Tool Co., 102 20th St., Moline, Ill.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
National Automatic Tool Co., Inc., S. 7th and N Sts., Richmond, Ind.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPPING MACHINES, Nut

Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
National Machinery Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.

TAPS

Besly-Welles Corp., Beloit, Wis.
Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Continental Tool Works, Div. Ex-Cell-O Corp., Detroit 32, Mich.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.

(Continued on page 380)

WHAT DOES FIRTH STERLING OFFER YOU?

(ANSWER NUMBER 2)

ONE SOURCE FOR ALL TOOLING NEEDS

THE *RIGHT* STEEL OR CARBIDE . . . THE *EXACT* METALLURGICAL COMBINATION NEEDED TO DO YOUR JOB BEST . . . FROM A SINGLE MANUFACTURING SOURCE

The next time you have a difficult tooling problem we invite you to call in a Firth Sterling man.

He may be called a "tooling specialist" or a "sales engineer" . . . but anyhow he's just a fellow who understands the *cutting*, *shaping* and *forming* of metals like nobody's business. He *may* be a graduate engineer, or he may have learned the hard way on a milling cutter, draw bench or press, but he *knows* the score.

He can give you an unbiased recommendation . . . because he has approximately 100 different grades of Firth Sterling high speed steels, and tool and die steels to choose from *and* a dozen grades of tungsten carbide in everything from die nibs to a virtually unlimited variety of standard and special carbide cutting tools and tips.

All this is backed by 64 years of leadership in the development and production of special purpose steels, and 21 years of pioneering in carbide and "powder metallurgy" applications.

It makes sense, that a company which engages in *all* phases of tooling metallurgy will serve your interests best.

Remember, Firth Sterling *is* a single, dependable source for complete shop tooling.

Firth Sterling Stands for Metallurgical Achievement—Past, Present, Future

I-2

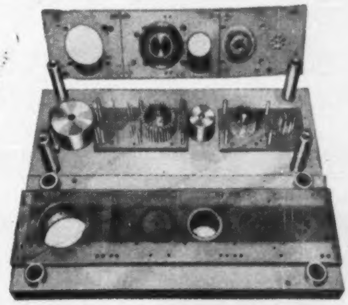
A VERSATILE FAMILY OF *Tool and Die Steels*

CROMOVAN • AIRVAN • INVARO

Certain steels or families of steel stand out as having almost universal application for general use, ranging from moderate to high production as job requirements demand. One such Firth Sterling family of steels consists of CROMOVAN, AIRVAN, and INVARO. CROMOVAN and AIRVAN are air hardening; INVARO is oil hardening.

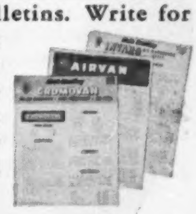
ANALYSES

	CROMOVAN	AIRVAN	INVARO
Carbon	1.60%	1.00%	.90%
Chromium	12.50%	5.25%	.50%
Vanadium	1.00%	.25%	.20%
Molybdenum	1.00%	1.15%	—
Manganese	—	—	1.15%
Tungsten	—	—	.50%



Generally speaking, CROMOVAN is intended for long production runs where hundreds of thousands or millions of pieces must be produced at minimum cost; AIRVAN for intermediate runs where toughness and high abrasion resistance are also requirements; INVARO, an oil hardening tool steel for all other general use.

Full technical details are available in these free bulletins. Write for them today or ask your Firth Sterling representative to call and discuss your tool and die needs . . . steel *or* carbide.



P-1

Firth Sterling
INC.

GENERAL OFFICES: 3113 FORBES ST., PITTSBURGH 30, PA.

OFFICES* AND WAREHOUSES: BIRMINGHAM* CHICAGO CLEVELAND DAYTON* DETROIT HARTFORD HOUSTON* LOS ANGELES NEW YORK* PHILADELPHIA* PITTSBURGH* WASHINGTON*

PRODUCTS OF FIRTH STERLING METALLURGY

High Speed Steels
Tool & Die Steels
Stainless Specialties
High Temperature Alloys

Sintered Tungsten Carbides
Firth Heavy Metal
Chromium Carbides
High Temperature Cermets

Landis Mch. Co. (Solid Adjustable), Waynesboro, Pa.
Morse Twist Drill & Mach. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford 1, Conn.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.
Winter Bros. Co., Rochester, Mich.
Wood & Spencer Co., 1930 E. 61st St., Cleveland, Ohio.

TAPS, Collapsing

Geometric Tool Co., Westville Station, New Haven 15, Conn.
Landis Mch. Co., Waynesboro, Pa.
National Acme Co., 170 E. 131st St., Cleveland, Ohio.
Sheffield Corp., 721 Springfield, Dayton, Ohio.

THREAD CUTTING MACHINERY

Brown & Sharpe Mfg. Co., Providence, R. I.
Cosa Corp., 405 Lexington Ave., New York 17, N. Y.
Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis.
Eastern Mch. Screw Corp., New Haven, Conn.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Kaufman Manufacturing Co., Manitowoc, Wis.
Landis Mch. Co., Waynesboro, Pa.
Magna Engineering Corp., 110 Linfield Drive, Menlo Park, Calif.
Pratt & Whitney, West Hartford 1, Conn.
Procunier Safety Chuck Co., 18 S. Clinton St., Chicago, Ill.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Snow Mfg. Co., 435 Eastern Ave., Bellwood, Ill.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

THREAD CUTTING TOOLS

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Detroit Tap & Tool Co., 8615 E. 8 Mile Rd., Base Line, Mich.
Eastern Mch. Screw Corp., New Haven, Conn.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Fellows Gear Shaper Co., 78 River St., Springfield, Vt.
Geometric Tool Co., Westville Station, New Haven 15, Conn.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Landis Mch. Co., Waynesboro, Pa.
Pratt & Whitney, West Hartford 1, Conn.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Taft-Peirce Mfg. Co., Woonsocket, R. I.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

THREAD GAGES

See Gages, Thread.

THREAD GRINDING MACHINES

See Grinding Machines, Thread.

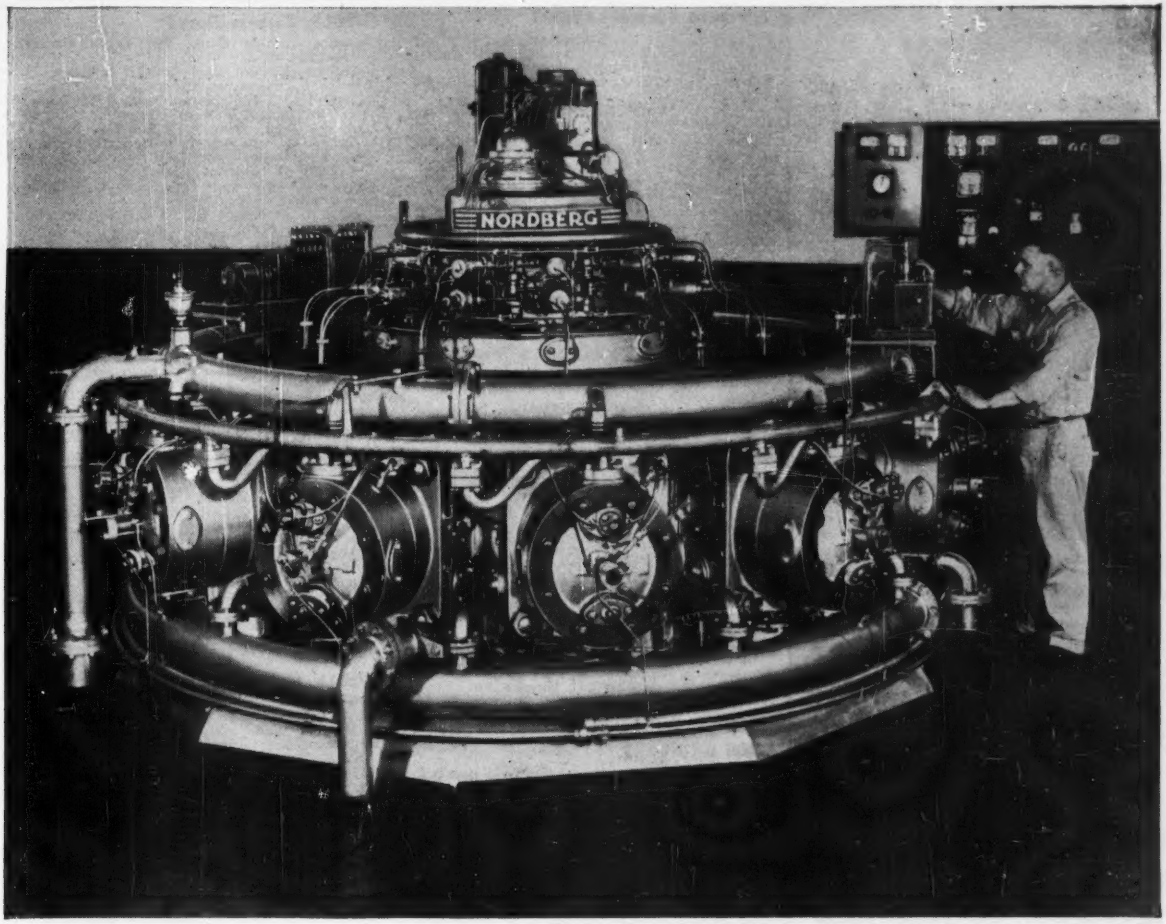
THREAD MILLING MACHINES

Coulter, James, Machine Co., 629 Railroad Ave., Bridgeport 5, Conn.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Hall Planetary Co., Fox St. and Abbotsford Ave., Philadelphia 29, Pa.
Hanson-Whitney Co., Div. Whitney Chain Co., Hartford, Conn.
Pratt & Whitney, West Hartford 1, Conn.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Sheffield Corp., 721 Springfield, Dayton, Ohio.
Waltham Machine Works, Newton St., Waltham, Mass.

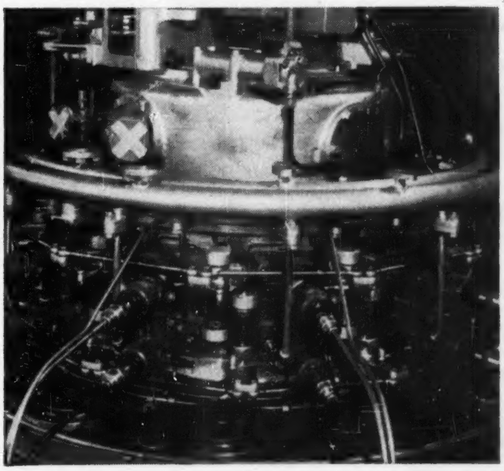
THREAD ROLLING MACHINES

Hartford Special Mchry. Co., 287 Homestead St., Hartford, Conn.
Hill Acme Co., 1201 W. 65th St., Cleveland 2, Ohio.
Reed Rolled Thread Die Co., P. O. Box 350, Worcester 1, Mass.
Salvo Tool & Engineering Co., 26441 Gratiot Ave., Roseville, Mich.
V & O Press Co., Div. Emhart Mfg. Co., Hudson, N. Y.

(*Continued on page 382*)



Here's Why The Nordberg Manufacturing Co. Uses *Summerill* Seamless Tubing



This close-up of the Nordberg two-cycle Radial Duafuel engine shows ½″ O.D. Summerill Tubing being used for the fuel oil and gas lines. . . a .107″ I.D. fuel oil pump line . . . and a .187 I.D. gas actuator pump line.

"For many years, we've used Summerill Cold Drawn Seamless Tubing in our Radial engine oil and/or gas fuel lines. It has been our experience that Summerill constantly maintains the high standard of quality required for our products."

This report from the Nordberg Manufacturing Co., Milwaukee, Wis., is typical of the results that hundreds of other Summerill customers have achieved. And we're ready to prove that you'll benefit in the same way, thanks to the exacting quality-control we exert at every step of production, from selection of prime raw materials to shipment of the finished product to you. ● Why not get together with us on your tubing problems? We'll gladly work with you to improve your product, reduce costs and eliminate fabrication difficulties. *Call or write today!* Summerill Tubing Co. Div., Columbia Steel & Shafting Co., Pittsburgh 30, Pennsylvania.

Summerill

TIN AND TERNEPLATES

Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (Carnegie-Illinois Steel Corp. Div., Columbia Steel Co. Div. Tennessee Coal, Iron & R. R. Co., Div.), 436 7th Ave., Pittsburgh, Pa.

TOOL BITS, High Speed Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Simonds Saw & Steel Co., 470 Main St., Fitchburg, Mass.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Wheelock-Lovejoy & Co., Inc., Cambridge, Mass.

TOOL BITS, Special Alloy

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Vanadium Alloys Steel Co., Latrobe, Pa.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TOOL GRINDERS

See Grinding Machines for Sharpening, Turning and Planing Tools.

TOOL GRINDING ATTACHMENTS

Detroit Reamer & Tool Co., 2830 E. 7 Mile Rd., Detroit, Mich.

TOOL HOLDERS

Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Davis Boring Tool Div., Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Lovejoy Tool Co., Springfield, Vt.
Maxwell Co., 420 Broadway, Bedford, Ohio.
Michigan Tool Co., 7171 E. McNichols Rd., Detroit, Mich.
Milholland, W. K., Mchry. Co., 6402 Westfield Blvd., Indianapolis 5, Ind.
OK Tool Co., Milford, N. H.
Portage Double Quick Tool Co., 1063 Sweitzer Ave., Akron 11, Ohio.
R and L Tools, 1825 Bristol St., Philadelphia 40, Pa.
Scully-Jones & Co., 1903 Rockwell St., Chicago 8, Ill. (Turret)
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Warner & Swasey Co., 5701 Carnegie Ave., Cleveland 3, Ohio.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.
Western Tool & Mfg. Co., 1640 Wheeler St., Springfield, Ohio.

TOOLMAKERS' INSTRUMENTS

Ames, B. C., Co., Waltham 54, Mass.
Brown & Sharpe Mfg. Co., Providence, R. I.
Scherr, George, Co., Inc., 200 Lafayette St., New York 12, N. Y.
Starrett, The L. S., Co., Athol, Mass.
Taft-Peirce Mfg. Co., Woonsocket, R. I.

TOOL STEEL

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Crucible Steel Co. of America, Chrysler Bldg., New York, N. Y.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Vanadium Alloys Steel Co., Latrobe, Pa.

TOOLS, Carbide-Tipped

Adamas Carbide Corp., 999 South 4th St., Harrison, N. J.
Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Atrax Co., Newington, Conn.
Beaver Tool & Engineering Corp., 2850 Rochester Rd., Box 429, Royal Oak, Mich.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Chicago-Latrobe Twist Drill Works, 411 W. Ontario St., Chicago, Ill.
Cleveland Twist Drill Co., 1242 E. 49th St., Cleveland, Ohio.
Eclipse Counterbore Co., 1600 Bonner Ave., Ferndale, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gairing Tool Co., 21225 Hoover Rd., Detroit 32, Mich.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Colonial Broach Co., Detroit 13, Mich.
Illinois Tool Works, 2501 North Keeler Ave., Chicago, Ill.
Kennametal, Inc., Latrobe, Pa.
Maxwell Co., 420 Broadway, Bedford, Ohio.
McCrosky Tool Corp., 1938 Thomas St., Meadville, Pa.
Metal Carbides Corp., Youngstown, Ohio.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
O. K. Tool Co., Milford, N. H.
Precise Products Corp., 1328-30 Clark St., Racine, Wis.
Super Tool Co., 21650 Hoover Rd., Detroit 13, Mich.
Union Twist Drill Co., Athol, Mass.
Wesson Metal Corp., Lexington, Ky.
Whitman & Barnes, 40600 Plymouth Rd., Plymouth, Mich.
Willey's Carbide Tool Co., 1340 W. Vernor Hwy., Detroit 1, Mich.

TOOLS, Lathe, Shaper and Planer

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Apex Tool & Cutter Co., Inc., 237 Canal St., Shelton, Conn.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bullard Co., Brewster St., Bridgeport 2, Conn.
Carboloy Dept., General Electric Co., Box 237, Roosevelt Park Annex, Detroit 32, Mich.
Firth Sterling Inc., 3113 Forbes St., Pittsburgh 30, Pa.
Gorham Tool Co., 14400 Woodrow Wilson, Detroit, Mich.
Haynes Stellite Div., Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.
Kennametal, Inc., Latrobe, Pa.
Lovejoy Tool Co., Inc., Springfield, Vt.
Northwestern Tool & Engrg. Co., 117 Hollier, Dayton, Ohio.
OK Tool Co., Milford, N. H.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Super Tool Co., 21650 Hoover Road, Detroit 13, Mich.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Wesson Co., 1220 Woodward Heights Blvd., Ferndale, Mich.

TRANSFER MACHINES, Automatic

Barnes Drill Co., 814 Chestnut St., Rockford Ill.
Barnes, W. F. & John, Co., 201 S. Water St., Rockford, Ill.
Colonial Broach Co., Detroit 13, Mich.
Cross Co., 3250 Bellevue Ave., Detroit 7, Mich.
Ex-Cell-O Corp., 1200 Oakman Blvd., Detroit 32, Mich.
Morris Machine Tool Co., Inc., 946-M Harriet St., Cincinnati 3, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TRANSFORMERS

General Electric Co., Schenectady, N. Y.

TRANSMISSION, Variable Speed

Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Reliance Electric & Engrg. Co., 1074 Ivanhoe Rd., Cleveland 10, Ohio.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., 90 Silliman St., Bridgeport 5, Conn.

TUBE FORMING AND WELDING MACHINES

American Elec. Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Yoder Co., 550 Walworth Ave., Cleveland.

(*Continued on page 384*)

TUBING, Aluminum

Aluminum Co. of America, Oliver Bldg., Pittsburgh, Pa.

TUBING, Brass and Copper

American Brass Co., 25 Broadway, New York, N. Y.
Chase Brass & Copper Co., Inc., 1949 Rodney St., Waterbury 20, Conn.
Revere Copper & Brass Inc., 230 Park Ave., New York, N. Y.

TUBING, Flexible

American Metal Hose Br. American Brass Co., 25 Broadway, New York, N. Y.
Titeflex, Inc., 500 Frelinghuysen Ave., Newark 5, N. J.

TUBING, Steel

Allegheny Ludlum Steel Corp., Pittsburgh, Pa.
Bethlehem Steel Co., Bethlehem, Pa.
Carpenter Steel Co., Reading, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
National Tube Div. U. S. Steel Corp., 525 Wm. Penn Place, Pittsburgh, Pa.
Republic Steel Corp., Steel & Tubes Div., Republic Bldg., Cleveland 1, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.
Summerill Tubing Co., Div. Columbia Steel & Shafting Co., P. O. Box 1557, Pittsburgh 30.
Timken Roller Bearing Co., Canton, Ohio.

TWIST DRILLS

See Drills, Twist.

UNIVERSAL JOINTS

Baush Machine Tool Co., 156 Wasson Ave., Springfield 7, Mass.
Boston Gear Works, 3200 Main St., North Quincy 71, Mass.

VALVE CONTROLS

Philadelphia Gear Works (Motorized), Erie Ave. and G St., Philadelphia, Pa.

VALVES, Air

Bellows Co., 230 W. Market St., Akron, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.
National Pneumatic Co., Inc., 127 Armory St., Boston 19, Mass.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Ross Operating Valve Co., 120 E. Golden Gate, Detroit, Mich.

VALVES, Hydraulic

American Steel Foundries, Elmes Engrg. Div., Paddock Rd. and Tennessee Ave., Cincinnati, Ohio.
Baldwin-Lima-Hamilton Corp., Philadelphia 42, Pa.
Barnes, John S., Corp., Rockford, Ill.
Denison Engrg. Co., 1160 Dublin St., Columbus 16, Ohio.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago, Ill.
Hunt, C. B., & Son, Inc., 1911 E. Pershing St., Salem, Ohio.
Hydraulic Press Mfg. Co., 300 Lincoln Ave., Mt. Gilead, Ohio.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
Oilgear Co., 1560 W. Pierce St., Milwaukee 4.
Rivett Lathe & Grinder, Inc., Brighton, Boston 35, Mass.
Sundstrand Mch. Tool Co., 2531 11th St., Rockford, Ill.
Turchan Follower Mch. Co., 8259 Livernois & Alaska Aves., Detroit, Mich.
Vickers, Inc., 1402 Oakman Blvd., Detroit, Mich.
Watson-Stillman Co., Div. H. K. Porter Co., Inc., Roselle, N. J.
Wood, R. D., Co., Public Ledger Bldg., Philadelphia 5, Pa.

VIBRATION INSULATION

American Felt Co., Glenville, Conn.

VISES, Machine

Armstrong-Blum Mfg. Co., 5700 W. Bloomingdale Ave., Chicago, Ill.
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Bellows Co., 250 W. Market, Akron, Ohio.
Brown & Sharpe Mfg. Co., Providence, R. I.
Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Hannifin Corp., 1101 S. Kilbourn Ave., Chicago.
Hendey Machine Co., Inc., Torrington, Conn.
Homestrand, Inc., Larchmont, N. Y.
Logansport Machine Co., Inc., 810 Center Ave., Logansport, Ind.
L-W Chuck Co., 24 S. St. Clair, Toledo, O.
Martin, J. E., Mch. Works, 548 W. State St., Springfield, Ohio.
Producto Mch. Co., 990 Housatonic Ave., Bridgeport, Conn.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.
Universal Engineering Co., Frankenmuth 2, Mich.

VISES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

VISES, Planer and Shaper

Brown & Sharpe Mfg. Co., Providence, R. I.
Cincinnati Shaper Co., Elam and Garrard Aves., Cincinnati, Ohio.
Martin, J. E., Mch. Works, 548 W. State St., Springfield, Ohio.
Rockford Mch. Tool Co., 2500 Kishwaukee St., Rockford, Ill.
Skinner Chuck Co., 344 Church St., New Britain, Conn.
South Bend Lathe Works, Inc., 425 E. Madison St., South Bend, Ind.

VISES, Pneumatic

Mead Specialties Co., 4114 North Knox Ave., Chicago 41, Ill.

VOLTMETERS

General Electric Co., Schenectady, N. Y.

WASHERS, Lock

Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WASHERS, Spring

Eaton Mfg. Co., Reliance Div., 25 Charles Ave., S. E., Massillon, Ohio.

WELDING AND CUTTING EQUIPMENT Oxyacetylene

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York, N. Y.

WELDING AND CUTTING GAGES

Linde Air Products Co., Div. Union Carbide & Carbon Corp., 30 E. 42nd St., New York.

WELDING EQUIPMENT, Electric, Spot,

Delta Power Tool Div., Rockwell Mfg. Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.
General Electric Co., Schenectady, N. Y.
Lincoln Electric Co., 22801 St. Clair Ave., Cleveland, Ohio.
Westinghouse Electric Corp., Pittsburgh 30, Pa.

WELDING EQUIPMENT, Electric, Spot, Butt, Seam, Etc.

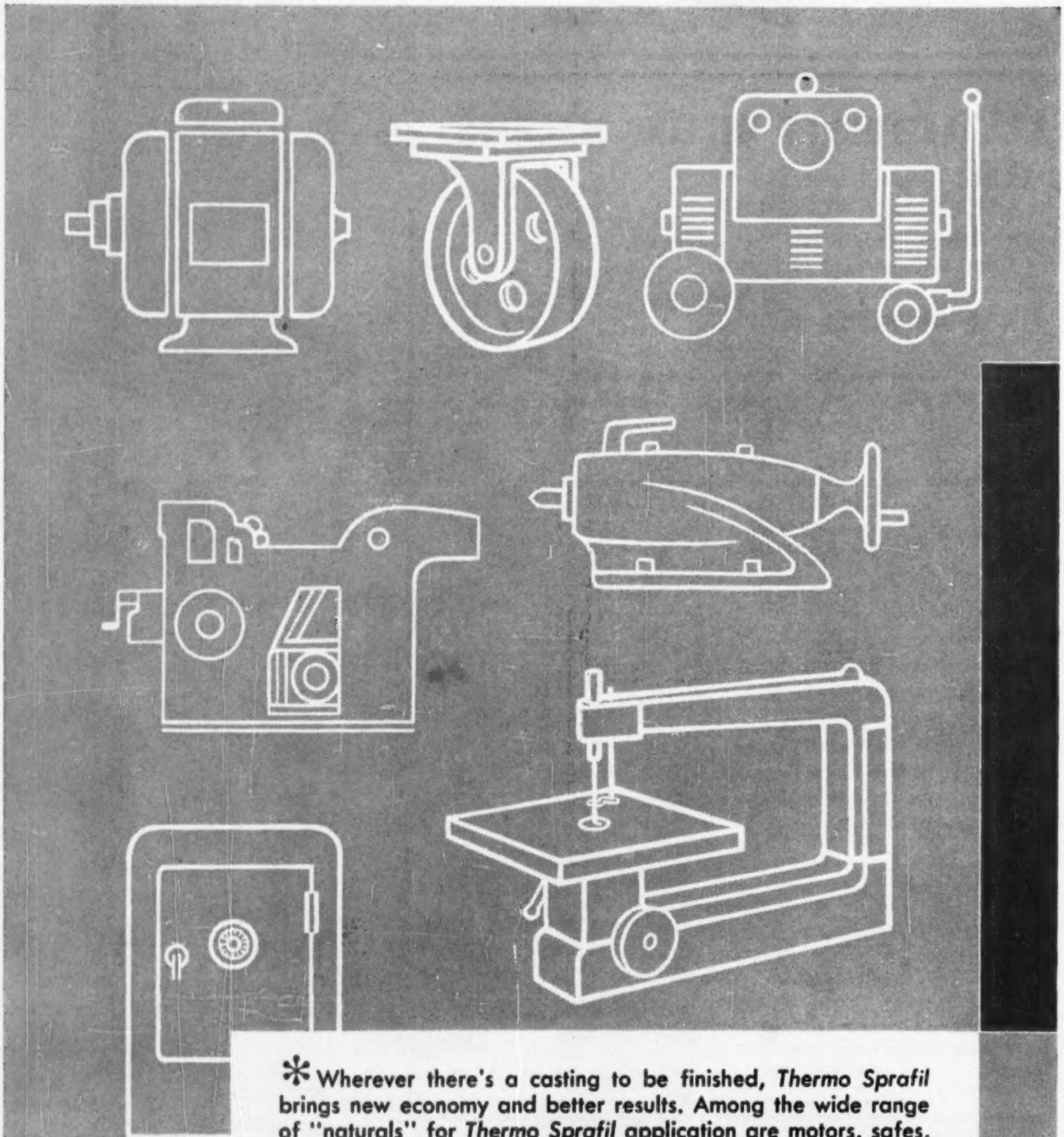
American Electric Fusion Corp., 2606 Diversey Ave., W., Chicago, Ill.
Delta Power Tool Div., Rockwell Mfg. Co., 641G N. Lexington Ave., Pittsburgh 8, Pa.
DoAll Co., 254 Laurel Ave., Des Plaines, Ill.
Expert Welding Machine Co., 17144 Mt. Elliott Ave., Detroit 12, Mich.

WELDMENTS

Mahon, R. C., Co., Detroit 34, Mich.
Woods, A. C., & Co., Div. Kropp Forge Co., 1129 Harrison Ave., Rockford, Ill.

(Continued on page 388)

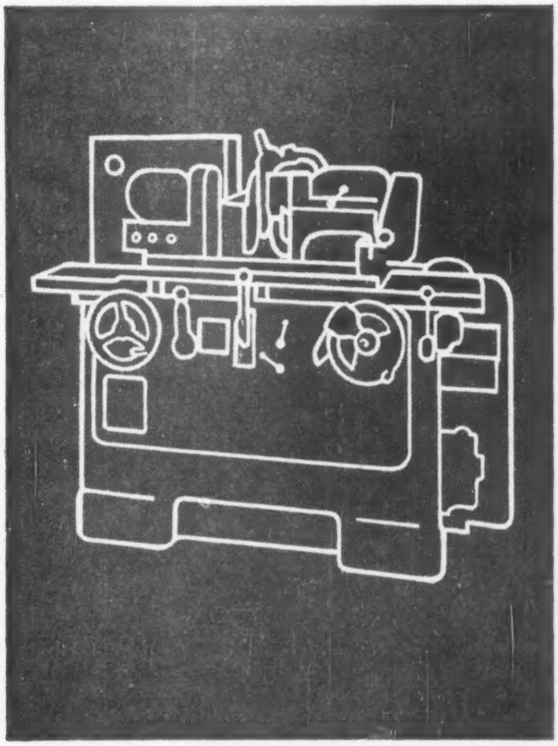
Lowe Brothers THERMO SPRAFIL®
20% of Manufacturer's



*Wherever there's a casting to be finished, *Thermo Sprafil* brings new economy and better results. Among the wide range of "naturals" for *Thermo Sprafil* application are motors, safes, casters, printing presses, welding and home workshop equipment —*and very likely the products you manufacture!* Write today!

Finishing System Saves Production Time!

When this large manufacturer of grinders* installed *Thermo Sprafil* at the suggestion of a Lowe Brothers "Finishing Specialist," he expected to see *some* savings in production time—but nothing like the 15% to 20% that actually resulted in the initial tests. Now, this manufacturer anticipates even *greater* savings as his production people learn to make fullest use of *Thermo Sprafil's time-saving* advantages!



This advertisement is based on facts taken from Lowe Brothers Industrial Case History Files.

How did *Thermo Sprafil* save so much production time in this plant? Here are the four reasons, plain and simple:

1. *Thermo Sprafil* reduced sanding—entirely eliminated need for sanding on smaller castings—sanded very easily where necessary at all.

2. *Thermo Sprafil* permitted straight-line, *non-stop* production and finishing—no costly delays for tedious filling operations. Higher solids content of *Thermo Sprafil* resulted in greater "build" for successful one-pass spray application.

3. Much less handling of castings—they stayed on the line and moved! *Thermo Sprafil* dried quickly—ready for the next operation in a few hours.

4. Less time consumed in actual application of the finish. *Thermo Sprafil* flowed on smoothly—no "pin-holing."

All down the line, *Thermo Sprafil* saved time for this manufacturer—and time is *money* on any production job. Take time now to check into *Thermo Sprafil* for *your* operation, and join the many other manufacturers who are enjoying faster production and better finishing results *at lower cost*. Get the full story from a Lowe Brothers "Finishing Specialist." Write today.

THE LOWE BROTHERS COMPANY • Dayton 2, Ohio
Industrial Division

LEADERSHIP THROUGH CONSISTENT SERVICE

Lowe Brothers
FINISHES FOR INDUSTRY

WIRE

American Steel & Wire Co., Div. U. S. Steel Corp., Rockefeller Bldg., Cleveland, Ohio.
Bethlehem Steel Co., Bethlehem, Pa.
Jones & Laughlin Steel Corp., Gateway Center No. 3 Bldg., Pittsburgh, Pa.
Republic Steel Corp., Republic Bldg., Cleveland 1, Ohio.
U. S. Steel Corp. (American Steel & Wire Co. Div., Columbia Steel Co. Div., Tennessee Coal, Iron & R. R. Co. Div), 436 7th Ave., Pittsburgh, Pa.

WIRE FORMING MACHINERY

Nilson, A. H., Mch. Co., 1506 Railroad Ave., Bridgeport, Conn.
U. S. Tool Co., Inc., 255 North 18th St., Ampere, N. J.

WIRE NAIL MACHINERY

Bliss, E. W., Co., 1375 Raff Rd., S. W., Canton, Ohio.
National Mchry. Co., Greenfield and Stanton Sts., Tiffin, Ohio.
Ryerson, Jos. T., & Son, Inc., 2558 W. 16th St., Chicago 18, Ill.

WOODWORKING MACHINERY

Delta Power Tool Div., Rockwell Mfg., Co., 614G N. Lexington Ave., Pittsburgh 8, Pa.
Frew Machine Co., 121 East Luray St., Philadelphia 20, Pa.
Greenlee Bros. & Co., 12th and Columbia Aves., Rockford, Ill.
Onsrud Machine Works, Inc., 3940 Palmer St., Chicago, Ill.
Walker-Turner Div., Kearney & Trecker Corp., 900 North Ave., Plainfield, N. J.

WORM DRIVES

Cleveland Worm & Gear Co., 3249 E. 80th St., Cleveland, Ohio.
Cone-Drive Gear Div., Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich.
Link-Belt Co., 2045 W. Huntington Park Ave., Philadelphia 40, Pa.
Ohio Gear Co., 1333 E. 179th St., Cleveland, Ohio.
Philadelphia Gear Works, Erie Ave. and G St., Philadelphia, Pa.

WRENCHES

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Cleco Div., Reed Roller Bit Co. (Impact, Pneumatic), 5125 Clinton Ave., Houston 20, Tex.
Ingersoll-Rand Co. (Impact, Pneumatic, Electric), Phillipsburg, N. J.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

WRENCHES, Detachable Socket

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.

WRENCHES, Pipe

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Peck, Stowe & Wilcox Co., Southington, Conn.

WRENCHES, Ratchet

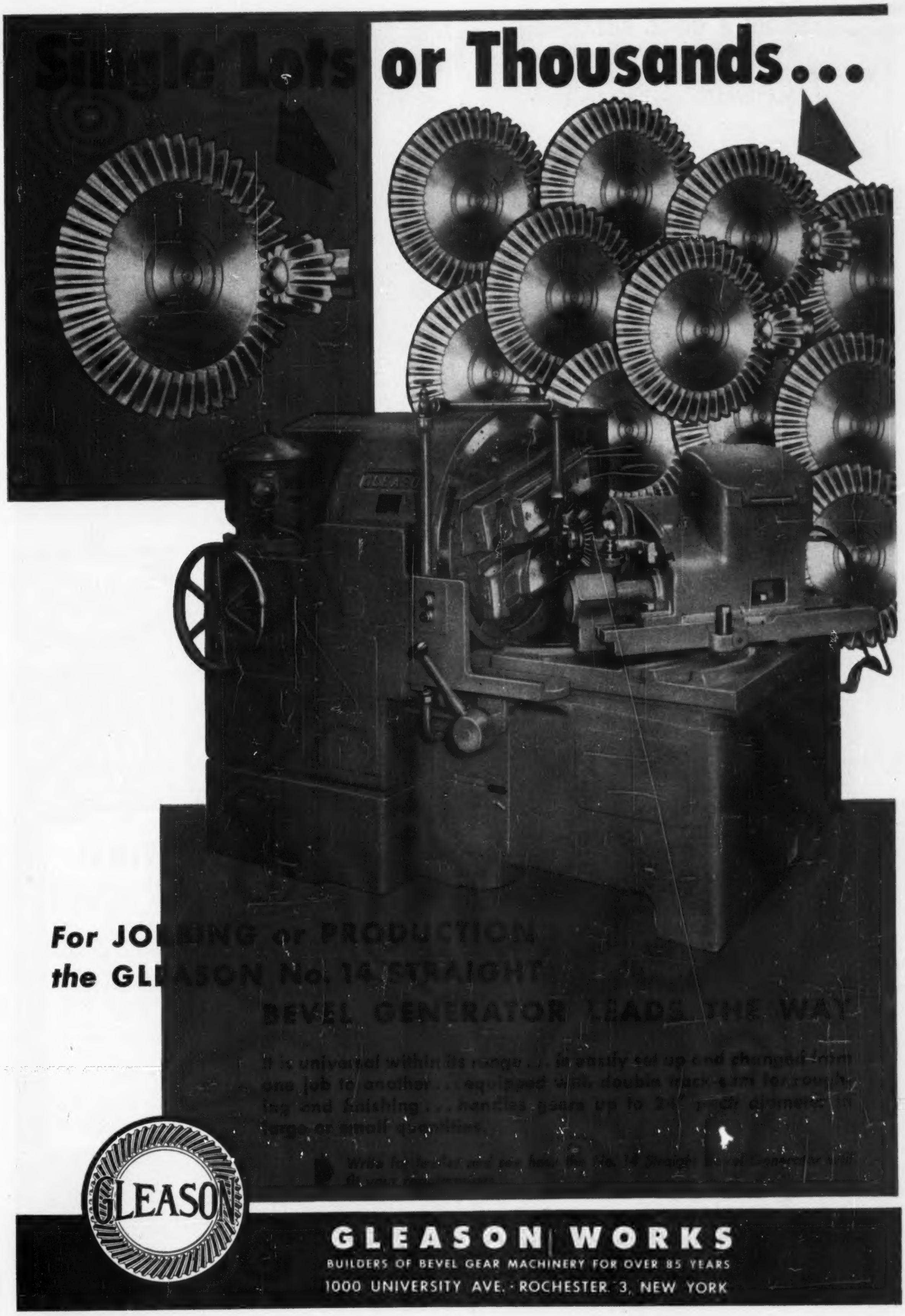
Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Keller Tool Co., Grand Haven, Mich.

WRENCHES, Tap

Butterfield Div., Union Twist Drill Co., Derby Line, Vt.
Card, S. W., Mfg. Co., Div. Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill & Mch. Co., New Bedford, Mass.
Pratt & Whitney, West Hartford, Conn.
Standard Tool Co., 3950 Chester Ave., Cleveland, Ohio.

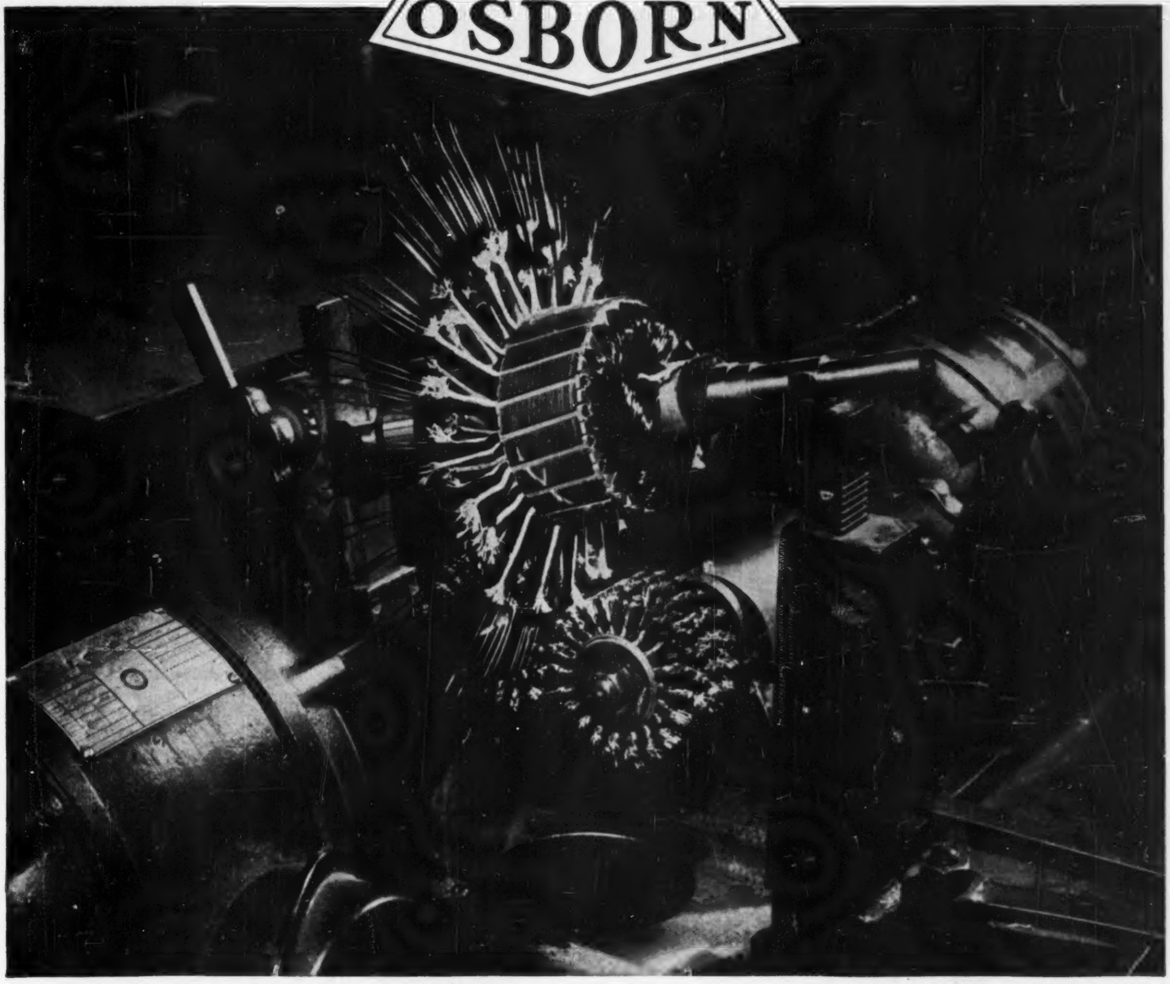
WRENCHES, Torque Measuring

Armstrong Bros. Tool Co., 5200 W. Armstrong Ave., Chicago, Ill.
Elastic Stop Nut Corp. of America, 2330 Vauxhall Rd., Union, N. J.
Sturtevant, P. A., Co., Addison, Ill.



Single Lots or Thousands...
For JOBBING or PRODUCTION
the GLEASON No. 14 STRAIGHT
BEVEL GENERATOR LEADS THE WAY
GLEASON
GLEASON WORKS
BUILDERS OF BEVEL GEAR MACHINERY FOR OVER 85 YEARS
1000 UNIVERSITY AVE. · ROCHESTER 3, NEW YORK

OSBORN

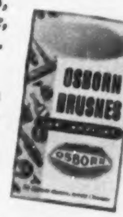


14 minutes by hand . . .
Now 3 minutes with push-button brushing

This strip act with Osborn wire brushes is taking off costly hours in the production of d-c motor armatures . . . typical of savings being discovered throughout industry with push-button brushing methods.

The job here is to remove enamel insulation from copper wires to assure top quality soldered connections. Formerly done by a tedious hand-scraping method, the time per armature was 14½ minutes. With the motor-driven brushing device shown the time has been cut to 3 minutes. As the armature is turned, a pair of Osborn Disc Center wire brush heads rotate downward on the wires and the insulation comes off clean.

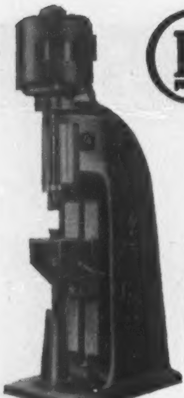
This is typical of thousands of production jobs which have been simplified with the help of the **O**sborn **B**rushing **A**nalyst. For help to improve *your* cleaning, finishing or deburring operations, call your **OBA** or write *The Osborn Manufacturing Company, Dept. D-8, 5401 Hamilton Avenue, Cleveland 14, Ohio.*



FREE: New booklet on deburring with Osborn Power Brushing. Write for your copy.

Osborn Brushes

OSBORN POWER, MAINTENANCE AND PAINT BRUSHES AND FOUNDRY MOLDING MACHINES



GRANT PIONEERS IN RIVETING

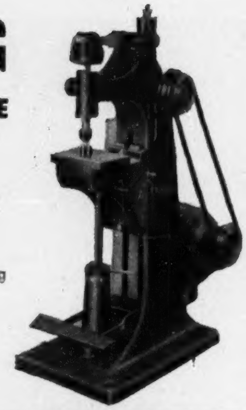
OVER 50 YEARS' EXPERIENCE

Noiseless Rivet Spinning Machines

BOTH SPINNER AND HAMMER TYPES

Single and Multiple Spindles—Vertical and Horizontal—Automatically or Foot-Operated. Handles rivets from the smallest and most delicate up to ¾" diameter.

Rotary Vibrating Riveters



THE GRANT MFG. & MACHINE CO.

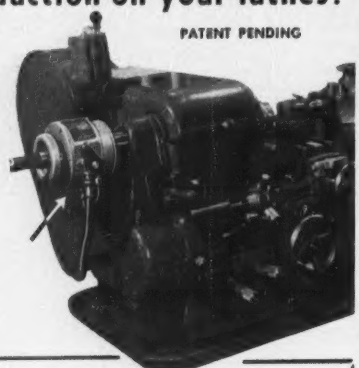
N.W. Station **Bridgeport 5, Conn.**

Increase production on your lathes!

WITH A

WILSON AIR COLLET CLOSER

PATENT PENDING



Leakproof! A neoprene inner-tube eliminates leaking rings, piston and packings

HERE'S HOW . . .

* Speed first and second operation work with "finger-tip" or foot control—reduce operator fatigue.
* Eliminate slippage—use an "iron-hand" grip. Eliminate damage to delicate parts—use a "finger-tip" grip.
* Hold consistent accuracy with controlled air pressure.
* Have automatic correction for variations in stock or machined parts.

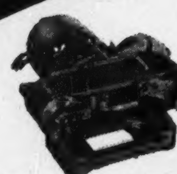
****** *You can do all these with a Wilson Air Collet Closer***

WRITE FOR FOLDER OR SEE YOUR DEALER

DURABLE PRODUCTS **Tel. PL 5550**
816 West 50th Street • Minneapolis 19, Minnesota

DOES IT BETTER... DOES IT FASTER

SIMPLEX-M
ABRASIVE BAND GRINDER



The precision of a machine tool plus the durability of a workhorse. Complete with ½ H.P. Heavy Duty Motor and automatic band tension control. Nothing like it for finishing metals, plastics, wood, fibre, etc.

OTHER STYLES AND SIZES IN NEW MANUAL ON FINISHING WRITE TODAY

WALLS SALES CORP.
333 Nassau Avenue, Brooklyn 22, N. Y.

POWER PRESSES

of all types and sizes

ZEH & HAHNEMANN CO.

182 Vanderpool Street
NEWARK, N. J.

CHICAGO

STEEL
PRESS BRAKES

43 Standard Sizes

DIES Punching and Forming for All Makes and Sizes of Press Brakes.

DREIS & KRUMP MANUFACTURING COMPANY
CHICAGO STEEL BENDING BRAKES BOX and PAN BRAKES PRESS BRAKES
7412 S. Loomis Blvd., Chicago 36, Illinois

TAPPING MACHINES · CAM MILLING MACHINES · DUPLEX DRILLING MACHINES · HAND MILLING MACHINES · PROFILERS · SPECIAL MACHINES

FREW

THE FREW MACHINE CO.
121 E LURAY STREET · PHILADELPHIA 20 PA

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choose

FERRACUTE INCLINABLES

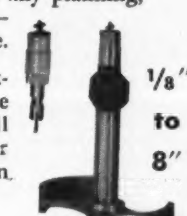
Fast . . . economical . . . dependable
Complete line of mechanical presses. Since 1863
FERRACUTE MACHINE CO., Bridgeton, N. J.

"Packaged Precision"

Measures high-precision holes to fractions of .0001", with these advantages—

Here in a compact self-contained unit, you have the high precision that has found so prominent a place in the jet engine program. By unique design, Comtorplug gives true 2-point gaging, self-aligned and centered. Thus, it enables you to check any part of a hole—including very bottom—detecting out-of-round, front or back taper, bell mouth, etc.

- There are no gimmicks to get out of order, such as wiring, hose or electronic gear. And because self-contained Comtorplug has none of these, and no heavy base, it is instantly usable anywhere: machine, bench, or lab.
- Shows actual measurement to fractions of .0001", and is "just right" for Statistical Quality Control programs.
- No skill needed to use it accurately—built-in features and 10 minutes instruction do the trick.
- Marvellous thing about Comtorplug from production man's viewpoint is that you can put it to work in your shop without any planning, wiring, air lines or rigmarole—just a simple briefing on its use.
- Comtorplug is a rugged, shock-proof instrument. Use it for size control at the machine as well as bench inspection, wherever you produce precision holes in volume.

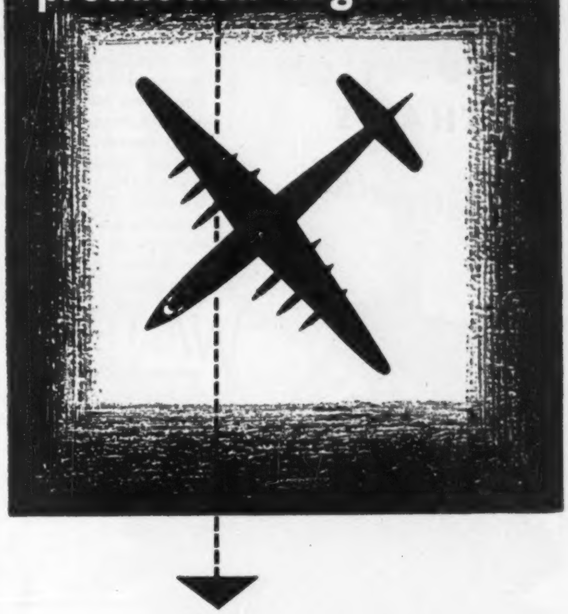


1/8" to 8"

REQUEST BULLETIN 46

COMTOR CO.
74 FARWELL STREET
WALTHAM 54, MASS.

production begins with



Columbus Die-Tool

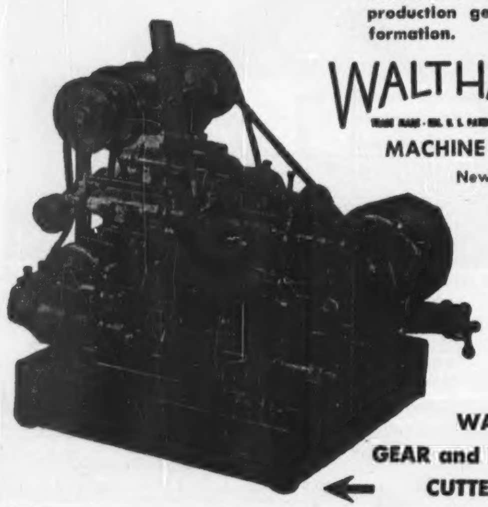
Get production off to a profitable start! Use Columbus Die-Tool engineered tools. Jigs, Fixtures, and Special Machinery individually designed and built to produce your product alone . . . at a rate to match your production schedule. That's production economy! That's the wisdom of CDT special machinery! That's how Columbus Die-Tool can put your production on a profitable basis. Columbus Die-Tool are specialists in building special tools, jigs, fixtures and machinery . . . have been for over 46 years. Talk over your special problems with us. Absolutely no obligation. Write today.

Columbus Die-Tool
AND MACHINE COMPANY
P. O. BOX 750 • COLUMBUS, OHIO
ESTABLISHED 1906

Manufacturers of
JIGS • FIXTURES • BUILDING MACHINE TOOLS COMPLETE
SPECIAL TOOLS • UNITS FOR MACHINE TOOLS

SMALL GEAR AND PINION PRODUCTION THAT'S *Automatic!*

Automatic loading and unloading feature eliminates lost motion in producing accurate small diameter, fine pitch gears and pinions on the Waltham. Individual motor drive through step cone pulleys gives a wide range of feeds and speeds. Compact design takes up less than 4 sq. ft. on the bench. If you want accurate . . . fast . . . economical small gear production get full information.



WALTHAM

MACHINE WORKS

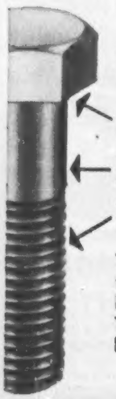
Newton Street
Waltham
Mass

THE WALTHAM GEAR and PINION CUTTER

When so much depends on so little

Don't settle for less than Chicago "*Safety Plus*" High Carbon Heat Treated Cap Screws

- For complete hardness from the center all the way out—no soft skin to cause wear or breakage due to fatigue.
- For freedom from scale — cleaner to handle — give a tighter thread fit — have smoother bodies.
- For extra safety — better appearance — ALL at no increase in cost to you.



You get these advantages with Chicago "Safety Plus" Heat-Treated Cap Screws.

Corners stay sharp . . . provide positive non-slip wrench grip . . . No decarburized surface.

Bodies wear longer . . . nominal diameter remains to size . . . No decarburized surface.

Threads without nicks . . . hold tighter in engagement . . . No decarburized surface.

Your Service-Conscious Industrial Supply Distributor carries a complete stock of our products. Ask him for samples of Chicago "Safety Plus" Heat Treated Cap Screws. His familiarity with your local field conditions enables him to fill your supply needs promptly and correctly. Ask for "Chicago" and get "Safety Plus".

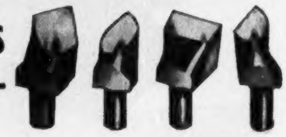
THE CHICAGO SCREW COMPANY

2501 WASHINGTON BOULEVARD
BELLWOOD, ILLINOIS

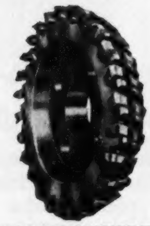
APEX TOOLS

INSERTED-BLADE MILLING CUTTERS AND SINGLE-POINT TOOLS FOR ALL METAL-CUTTING NEEDS

APEX TOOL BITS FIT MOST STANDARD HOLDERS



If you haven't yet changed to Apex, you can begin to get acquainted by using Apex Bits in your present holders. The Apex line includes Single-Point Round Shank (as shown) and Shankless Serrated — plus Inserted-Blade Milling Cutters of all different styles. Write for catalog.



PROMPT SHIPMENT FROM OUR LARGE, COMPLETE STOCK

APEX TOOL & CUTTER CO., Inc., Shelton 11, Conn.

HARDNESS TESTING

Brinell—Shore—Scale

Included in our improved Portable Scleroscope Model D-1. This efficient single scale tester registers Brinell-Shore values without damage to the work. The old standby for forty-three years.

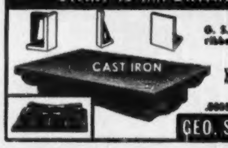
WRITE FOR CIRCULAR

THE SHORE INSTRUMENT & MANUFACTURING CO., INC.

90-35 Van Wyck Expressway, Jamaica, 35, N.Y.

ACCURACY IN SURFACES FROM WHICH MEASUREMENTS START IS IMPORTANT

TO BE CERTAIN — SPECIFY G. S. SURFACE PLATES AND ANGLE IRONS



CAST IRON

G. S. Cast Iron Plates are scientifically ribbed and handscraped by experts.

BLACK GRANITE

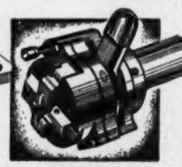
MICRO-FLAT

"The Gift of Nature"
.00005" or .0001" Surface Precision

Request Illustrated folder

GEO. SCHERR CO., Inc. 200-MA Lafayette St., N.Y.12.

famous for accuracy and straightness of threads, low chaser costs, less downtime, more pieces per day.



See our Advt on page 417 May 1953

THE EASTERN MACHINE SCREW CORP., 23-43 Barclay St., New Haven, Conn. Pacific Coast Representative: A. C. Behringer, 334 N. San Pedro St., Los Angeles, Calif. CANADA: F. F. Barber Machinery Company, Toronto.

only

THRIFTMASTER
Universal Joint Type
DRILL HEADS

have these exclusive* features

6 Standard Models

Models U-608 and U-1000 —Ball Bearing

Models U-620B and U-1012B — Plain Bearing, 11/16" or 1/2" min. centers.

Models U-608-BS and U-1000-BS — Ball Bearing Gear Case, Plain Spindles

Semi-Standard Heavy Duty Full Ball Bearing

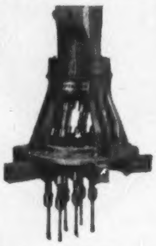
1/2" in Cast Iron — 1 7/6" min. centers 7 1/8" or 9 3/4" Dia.

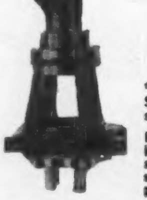
1/2" in steel—1 13/16" min. centers 7" or 9 5/8" Dia.

Also Larger Adaptations and Full Line of Fixed Center Drill Heads.

* Standard Full Ball Bearing Construction, including Spindles

Driving assembly in FULL BALL BEARING mounted with 3 Bearings on each spindle. Thrust load carried by radial thrust bearings.





* Standard Slip-On and Slip-Off Template Construction

For accurate setting and locating spindle brackets are machined to receive slip-on and slip-off template.

WRITE FOR FULL INFORMATION

Subsidiary of Thomson Industries, Inc.

THRIFTMASTER *Products Corporation*

1076 N. PLUM STREET
LANCASTER, PENNA.

Also Makers of DORMAN AUTOMATIC REVERSE TAPPERS

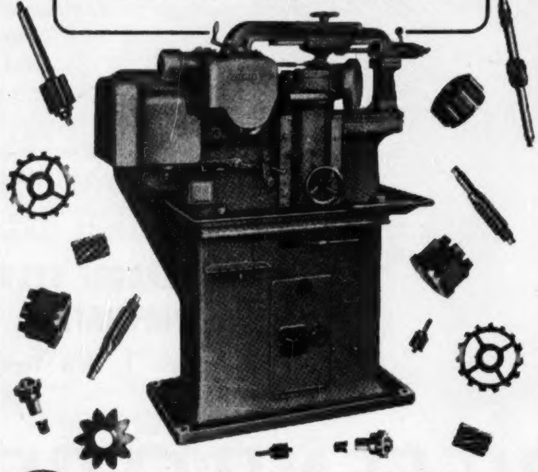
WHO*

makes the finest in
CAP SCREWS · SET SCREWS · MILLED STUDS
and COUPLING BOLTS

*Wm. H. Ottemiller Co.
YORK, PENNA.

KOEPFER GEAR HOBBING MACHINE

A Universal Purpose Machine for the economical production in either small or large quantities of Spur Gears and Pinions, Spiral Gears, Worms as well as Worm Wheels.



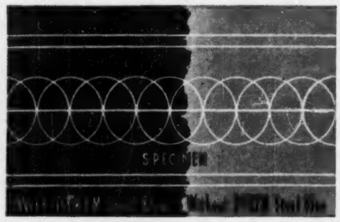
WRITE FOR ILLUSTRATED FOLDER

GEORGE SCHERR CO., Inc.
COMPLETE LINE OF PRECISION INSTRUMENTS
200-MA LAFAYETTE ST. • NEW YORK 12, N.Y.

DYKEM STEEL BLUE

STOPS LOSSES

making dies & templates



Simply brush on right at the bench; ready for the layout in a few minutes. The dark blue background makes the scribed layout lines show up in sharp relief, and at the same time prevents metal glare. Increases efficiency and accuracy.

Write for full information

THE DYKEM COMPANY, 2303P North 11th St., St. Louis 6, Mo.

CUT SCRAPER TIME

END NIGHT CLEANUP & MORNING REBLUING

DYKEM HI-SPOT BLUE No. 107 is used to locate high spots when scraping bearing surfaces. As it does not dry, it remains in condition on work indefinitely, saving scraper's time. Intensely blue, smooth paste spreads thin, transfers clearly. No grit; noninjurious to metal. Uniform. Available in collapsible tubes of three sizes. Order from your supplier. Write for free sample tube on company letterhead.

THE DYKEM CO., 2303P NORTH 11TH ST., ST. LOUIS 6, MO.

EISLER JIG BORING • CAMS

A SPECIALIZED CAM
MILLING SERVICE . . JIG BORING
SPOT WELDING . . CONTRACT
PRODUCTION . . EXPERIMENTAL
DEVELOPMENT

EISLER ENGINEERING CO., Inc.
Chas. Eisler, Pres.
736 So. 13th ST. NEWARK [illegible]

Classified and Re-Sale Section

OUTSTANDING MACHINE TOOLS

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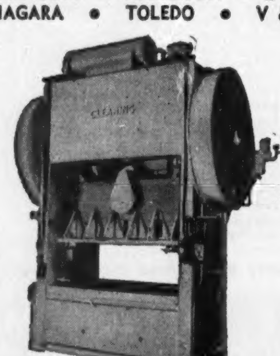

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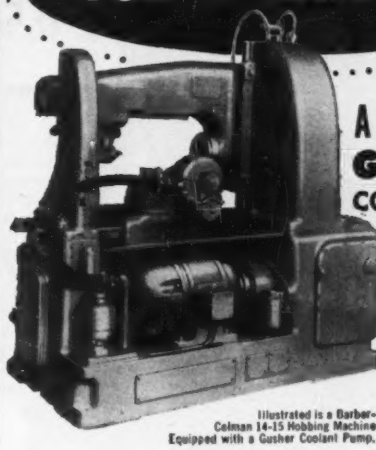

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